

Oxford Revise | AQA A Level Geography | Answers

Chapter 1

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–6 are point-marked. Allow 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Dynamic equilibrium involves a balance between carbon sources and carbon sinks (1).
 - The concept involves the flow of carbon molecules between different stores, such as atmosphere, biosphere, and hydrosphere (1).
 - Negative feedback mechanisms are key to dynamic equilibrium (1). As atmospheric CO2 increases, carbon uptake by plants increases, lowering atmospheric CO2 (1).
 - Global warming as example of human activities interrupting dynamic equilibrium (1).

Example answer: Dynamic equilibrium involves a balance between carbon sources and carbon sinks. It involves the flow of carbon molecules between different stores, such as atmosphere, biosphere, and hydrosphere, so that the amount of carbon entering and leaving these stores is balanced. Negative feedback mechanisms are key to dynamic equilibrium. As atmospheric CO2 increases, carbon uptake by plants increases, lowering atmospheric CO2. Human activities have interrupted dynamic equilibrium resulting in global warming.

- **2** AO1 = 4
 - Evaporation is conversion of liquid water into water vapour involving heat from the Sun (1)
 - Transportation of water vapour by air currents (1).
 - Transpiration by plants with water vapour leaving stomata, released into air (1).
 - Condensation and return of water vapour to the biosphere/soils for uptake by plants (1).
 - Evapotranspiration is influenced by, for example, density of vegetation, type of leaf cover (large surface area), soil moisture (1).

3 AO1 = 4

- Natural variations such as wildfires and volcanic eruptions, releasing large amounts of carbon into the atmosphere from the biosphere (1).
- Changes in vegetation cover, such as desertification or deforestation, reducing sequestration of carbon from the atmosphere store into plants and soils (1).
- Combustion of fossil fuels for energy production and transportation, from lithosphere to atmosphere (1).
- Changes in land use, such as farming practices, urbanisation, e.g. increasing decomposition of organic material in soils, releasing carbon into the atmosphere (1).
- Climate change, e.g. rising temperatures causing thawing of permafrost, releasing carbon from soil store into the atmosphere (1).
- Changes in the rates of photosynthesis, respiration, decomposition, and weathering also affect magnitude (1).



- **4** AO1 = 4
 - Role of the water cycle in supplying water used in photosynthesis (1), providing energy for secondary consumers and oxygen for living organisms as by-product (1).
 - Role in replenishing stores of fresh water, on which terrestrial life on Earth depends (1).
 - Regulating climate: evaporation absorbs heat energy, condensation releases heat energy (1), role this has in regulating temperature extremes (1).
 - Water vapour as (most abundant) greenhouse gas, helping to sustain life through warmer global temperatures (1).
 - Water cycle's role in providing range of habitats, e.g. ponds, lakes, swamps (1).
- **5** AO1 = 4
 - Ability of carbon dioxide to dissolve in water to form carbonic acid (1).
 - Uptake of carbon into the surface water of the oceans (1).
 - Role of water cycle and carbon cycle in chemical weathering of rocks (1).
 - In respiration: release of both CO2 and water vapour into the atmosphere (1).
 - In photosynthesis: carbon from the air combines with water taken up by plants (1).
 - Higher levels of atmospheric CO2 reduce the amount plant stomata need to open, reducing release of water vapour into the atmosphere through evapotranspiration (1).
- 6 AO1 = 4
 - The water balance is the balance between inputs and outputs over a period of time (1);
 (P) = (O) + (E) +/- (S) (1).
 - Concept of inputs explained: precipitation as primary input (1).
 - Concept of outputs: total runoff explained, EVT (1).
 - Concept of stores and role in water balance explained (1).
 - Importance of water balance for drainage basin management (1).

Questions 7–20 are level-marked.

AO1 – Knowledge and understanding of the carbon cycle. Awareness of deforestation, its causes, and impacts.
 AO2 – Application of knowledge to show how and why changes to forest cover impact on the carbon cycle.
 AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 Thorough, detailed, organised, and relevant throughout with supporting evidence and examples. Communicates detailed, clear knowledge and understanding. Communicates using developed statements and ideas (e.g. uses connectives to fully explore ideas). Good use of geographical terms and vocabulary.
1	1–3	 Sound throughout with some supporting evidence and examples. Communicates some knowledge and understanding. Communicates using linked statements and ideas (e.g. uses connectives, but needs further development). Some use of geographical terms and vocabulary.



- Global distribution, and size of major stores of carbon lithosphere, hydrosphere, cryosphere, biosphere, atmosphere.
- Factors driving change in the magnitude of these stores over time and space, including flows and transfers at plant, sere and continental scales. Photosynthesis, respiration, decomposition, combustion, carbon sequestration in oceans and sediments, weathering.
- Changes in the carbon cycle over time, to include natural variation (including wildfires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).

AO2

- The graphic shows a significant reduction in carbon sequestration post-disturbance (deforestation and land use change), suggesting that the impact of (tropical rainforest) deforestation on the carbon cycle is significant.
- Pre-disturbance, vegetation is shown taking up carbon dioxide (CO2) in both the upland and seasonally inundated rainforest. This occurs through photosynthesis: very high rates in tropical rainforest.
- Post-disturbance, a reduced uptake of carbon is shown due to deforestation and land use changes, clearing the rainforest trees and replacing them with crops that photosynthesis at a greatly reduced rate.
- Post-disturbance, the region has become a source of carbon due to forest fires (combustion of carbon stores) and increased release of methane (CH4) from livestock.
- Pre-disturbance, organisms (floating macrophytes) in rivers, streams and swamps (freshwater) absorbed CO2 from the atmosphere, while carbon was also stored in sediments. Post-disturbance (building of reservoirs and draining of seasonally inundated forest, this carbon store has become a carbon source due to the lack of vegetation in the reservoir.

Example answer: The graphic shows a significant reduction in carbon sequestration post-disturbance, as a result of deforestation and subsequent land use change. This suggests that there is significant impact of rainforest deforestation on the carbon cycle. The pre-disturbance graphic shows that vegetation takes up carbon dioxide through photosynthesis in both the upland and seasonally inundated rainforest. Rates of photosynthesis are very high rates in tropical rainforest, so any reduction has significant effects. Post-disturbance, a reduced uptake of carbon is shown due to deforestation (and the methods used, such as burning) and land use changes. Rainforest trees are cleared and replaced with crops that photosynthesise at a greatly reduced rate. Post-disturbance, the region has become a carbon source, rather than a carbon sink, due to forest fires (combustion of carbon stores) and increased release of methane (CH4) from livestock.

8 AO3 – Analysis of soil moisture data for the UK to identify patterns and anomalies in the data, using data manipulation to support response.

AO3 = 6

Level	Marks	Description
2	4–6	 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.
1	1–3	• 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.



- The data shows general east–west division, with soil moisture at normal levels for May 2023 in the east, and soil moisture drier than normal in the west. This is useful as it suggests a pattern.
- Northern Ireland did not follow this pattern as its soil moisture levels were at normal levels.
- Having information on the soil wetness status was useful as it indicates how far from normal the status was. For example, some sites (e.g. Glensaugh in Scotland, Gisburn Forest, Cardington, and Tadham Moor in England) were wetter than normal.
- Soil moisture levels are likely to generally follow precipitation patterns, suggesting that, while precipitation in May was normal for the east of the UK and Northern Ireland, it was probably below average for the west of England and Wales. However, for the purposes of depicting the general pattern of soil moisture across the UK, a second figure showing precipitation patterns would have increased the usefulness.
- Other factors could be involved for the sites with wetter than normal soil moisture, e.g. localised heavy precipitation (thunderstorms), changes to drainage patterns or changes to land use. This makes Figure 2 less useful in depicting the pattern of soil moisture across the UK.
- One reason for increased soil moisture could be the removal of surface vegetation vegetation draws up moisture from the soil and releases it into the atmosphere through EVT. Data on land use would therefore add to the usefulness of Figure 2 in explaining soil moisture patterns, though not in depicting them.
- 9 AO3 Analysis of natural and human-induced changes in the carbon cycle to identify patterns and anomalies in the data, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

- The natural carbon cycle (pre-industrial) shows a status of dynamic equilibrium, with flows between the atmosphere and hydrosphere broadly balanced (80 GtC of CO2 dissolving into the ocean and 78 GtC emitted from the ocean), also seen in flows between the atmosphere and biosphere (123 GtC sequestered by photosynthesis, 118 GtC emitted by respiration).
- The vast majority of carbon (100,000,000 GtC) is in the lithosphere. If all stores are added together (taking soil as 2400 GtC), then the lithosphere makes up 99.96 per cent of all carbon.
- The influence of human activities is most significant in the extraction of carbon from lithosphere fossil fuels (-365 GtC since 1750). This will have made the biggest contribution to the +240 GtC of carbon entering the atmosphere store.
- The importance of the oceans in reducing the impact of increased emissions from combusting fossil fuels is made clear by the +155 GtC entering the hydrosphere.
- The impact of deforestation and land use changes is probably seen in the –30 GtC reduction in the biosphere, with a reduction in sequestration by photosynthesis.
- **10** AO3 Analysis of data of rates of water withdrawal in the carbon cycle to identify patterns and anomalies in the data, using data manipulation to support response.

AO3 = 6



Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

- Groundwater withdrawal (abstraction) has increased at different rates, with two of the selected countries (Russia and France) showing declines in groundwater abstraction.
- India shows a very rapid increase in the rate of groundwater withdrawal, from approximately 10 km³/year in 1950 to 260 km³/year in 2020, a percentage increase of 2500 per cent, although the graphic shows signs of this rate levelling off.
- China showed a rapid increase between 1950 and 2000 (from approximately 10 km³/year in 1950 to 105 km³/year in 2000, a 950 per cent increase), but since then the rate has remained steady at around 105 km³.
- The USA has seen a similar trend to China, although starting from a higher rate in 1950 and with a steadier increase to 1990, since when it has remained constant.
- Abstraction of groundwater is usually highest in regions where precipitation inputs are low and rates of evapotranspiration are high. Countries with relatively high inputs of precipitation will therefore see lower rates of withdrawal than arid and semi-arid countries.
- Abstraction rates in India are likely to have increased due to increased demand for fresh water. This could be related to several factors including population increase (more people needing water), economic development (higher demand for water in manufacturing and energy production (cooling)) and agricultural changes (increase in irrigated farmland, for example).
- AO1 Knowledge and understanding of the carbon cycle. Human interventions in the carbon cycle.
 AO2 Application of knowledge to show effectiveness of human interventions in the carbon cycle with the intention of mitigating climate change impacts.
 AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.



- Changes in the carbon cycle over time, to include natural variation (including wildfires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).
- Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.

- The photo shows the Drax power station, which burns biomass to generate electricity, an example of BECCS. This is designed to mitigate the impacts of climate change by reducing greenhouse gases by combusting renewable resources (biomass from the biosphere) instead of fossil fuels (from the lithosphere).
- The photo shows that the process of generating energy in this way does still produce emissions. In this case, they are likely to be emissions of water vapour, since most electricity is generated in ways that require water for cooling or water in the form of steam to power turbines.
- Compared to other human interventions to mitigate climate change, BECCS may have strengths and weaknesses. A strength would be that growing biomass captures carbon dioxide from the air, and though burning it may then release carbon back into the atmosphere, inputs out of and back into the atmosphere are balanced, unlike with fossil fuels. If carbon capture and storage were also involved, then BECCS could start to reduce atmospheric carbon levels.
- A weakness of many human interventions to mitigate climate change is that the scale of the impact is very small compared with the excess carbon in the atmosphere and the rate at which greenhouse gas emissions need to be reduced to stop the impacts of climate change becoming severe.
- 12 AO3 Analysis of data of CO₂ measurements in both the atmosphere and seawater to identify patterns and anomalies in the data, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.
		 Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- The graph shows an increasing/positive trend in recorded atmospheric CO₂ at Mauna Loa, with a similar upward/positive trend in the amount of CO₂ dissolved in seawater. The graph shows a downwards/negative trend in seawater pH.
- There is a positive correlation between atmospheric and seawater CO₂ and a negative correlation between seawater CO₂ and seawater pH.
- Atmospheric CO₂ is shown to have increased by approximately 85 ppm (parts per million) from approximately 320 ppm to approximately 405 ppm between 1958 and 2018. Climate science has proved that this increase is due to human activities, primarily the combustion of carbon, adding significantly to the atmosphere store.



- The increase in CO₂ shows more variation, but a line of best fit indicates an increase from approximately 320 ppm when records began in 1990 to approximately 375 ppm (55 ppm) in 2018. Over the same period, atmospheric CO₂ increased from 350 ppm to 405 ppm (55 ppm) indicating a strong correlation.
- Atmospheric CO₂ dissolves into seawater, with higher concentrations of CO₂ in the atmosphere leading to more CO₂ being dissolved.
- Carbon dioxide reacts with water to form carbonic acid (H₂CO₃), and the graph indicates that as more CO₂ dissolves into the ocean from the atmosphere, the ocean's natural alkaline pH is becoming more acidic.
- 13 AO1 Knowledge and understanding of the carbon cycle. Human interventions in the carbon cycle.
 AO2 Application of knowledge to show effectiveness of human interventions in the carbon cycle with the intention of mitigating climate change impacts.
 AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

- Changes in the carbon cycle over time, to include natural variation (including wildfires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).
- 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.

- The graph compares per capita greenhouse gas (GHG) emissions on the *y*-axis with population in millions on the *x*-axis.
- The countries that produce the most GHG emissions per capita are not the countries with the largest populations in fact, Southern Asia with 2 billion people has emissions of 3 tonnes of CO₂ per capita per year, while North America with around 200 million people has emissions of 24 tonnes of CO₂ per capita per year.
- This is partly related to economic development: the countries with the highest GHG emissions include the highly industrialised economies of North America and Japan. Western Europe, although highly industrialised, is an anomaly here.



- Eastern Europe has relatively high emissions, perhaps due to historic dependence on heavy industry. Middle East has relatively high emissions, perhaps due to high dependence on energy for cooling and desalinisation.
- There is also a difference between regions where land use change makes a higher or equal contribution to GHG emissions than fossil fuel and industry emissions: Latin America and Caribbean and South-East Asia and Pacific in particular.
- This is likely to be related to deforestation of tropical rainforest, which reduces sequestration and increases emissions due to burning of forested land to clear it for agriculture.
- Challenges of reducing GHG emissions related to this include: highly industrialised countries having high emissions per capita because of, for example, air travel, individual car ownership, convenience-based consumer lifestyle. Reducing emissions involves significant lifestyle changes likely to be unpopular. Developing economies have lower emissions per capita but may be on a development trajectory that will increase emissions per capita as, for example, car ownership and use increases. Large populations in these countries add to the challenge. Countries are also deforesting in order to industrialise, which is the route to economic development taken by the most industrialised countries. Reducing emissions relies on forests remaining a significant carbon sink, so this represents a major challenge for reducing GHG emissions.
- 14 AO1 Knowledge and understanding of key themes of the carbon cycle in a tropical rainforest. Knowledge and understanding of impacts of increased carbon emissions. Knowledge and understanding of a tropical rainforest case study.

AO2 - Application of knowledge and understanding to assess the factors driving change in the magnitude of carbon stores over time in the case study region.AO1 = 10 AO2 = 10

Level Marks Description 4 16-20 AO2 – 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. AO1 – 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. 11-15 3 AO2 – 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. AO1 – Generally clear and relevant knowledge and understanding of place(s) and environments.



AO1 – General	ly clear and accurate knowledge and understanding of key
concepts, proc	esses and interactions and change.
AO1 – General	ly clear awareness of scale and temporal change which is
integrated whe	ere appropriate.
2 6–10 • AO2 – Some se	nse of an evaluative conclusion partially based upon knowledge
and understan	ding which is applied to the context of the question.
AO2 – Interpre	tations are partial but do support the response in places. Some
partially releva	nt analysis and evaluation in the application of knowledge and
understanding	
AO2 – Some ev	vidence of links between knowledge and understanding to the
application of l	knowledge and understanding in different contexts.
AO1 – Some re	levant knowledge and understanding of place(s) and
environments	which is partially relevant.
AO1 – Some kr	nowledge and understanding of key concepts, processes and
interactions ar	d change. There may be a few inaccuracies.
AO1 – Some av	vareness of scale and temporal change which is sometimes
integrated whe	ere appropriate. There may be a few inaccuracies.
1 1–5 • AO2 – Very lim	ited and/or unsupported evaluative conclusion that is loosely
based upon kn	owledge and understanding which is applied to the context of the
question. Inter	pretation is basic.
AO2 – Very lim	ited analysis and evaluation in the application of knowledge and
understanding	. This lacks clarity and coherence.
AO2 – Very lim	ited and rarely logical evidence of links between knowledge and
understanding	to the application of knowledge and understanding in different
contexts.	
AO1 – Very lim	ited relevant knowledge and understanding of place(s) and
environments.	
environments. AO1 – Isolated	knowledge and understanding of key concepts, processes and
	knowledge and understanding of key concepts, processes and d change. There may be a number of inaccuracies.
 AO1 – Isolated interactions an AO1 – Very lim 	knowledge and understanding of key concepts, processes and d change. There may be a number of inaccuracies. ited awareness of scale and temporal change which is rarely
 AO1 – Isolated interactions an AO1 – Very lim integrated when 	knowledge and understanding of key concepts, processes and d change. There may be a number of inaccuracies. ited awareness of scale and temporal change which is rarely ere appropriate. There may be a number of inaccuracies.

- Changes in the carbon cycle over time, to include natural variation (including wildfires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).
- The carbon budget and the impact of the carbon cycle upon land, ocean and atmosphere, including global climate.
- The key role of the carbon and water stores and cycles in supporting life on Earth with 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.
- 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.



- Answers are expected to apply knowledge and understanding of factors driving change in the magnitude of carbon stores to a chosen tropical rainforest case study over time.
- In terms of causes of changes to carbon stores, answers should refer to deforestation (reducing the role of tropical forests as a global carbon sink), burning of forest vegetation, use of deforested land for farming, which is a carbon source (especially livestock farming with the release of methane as a waste product of digestion).
- Answers should refer to specific case study detail, e.g. for causes: since 2000, Amazonia has lost 20.3 per cent of its original forest, 70 per cent of which has been to clear land for cattle ranching; for impacts: temperatures in Amazonia are predicted to rise by 3°C by 2050. There has been an increase in droughts in the Amazonia region severe droughts occurred in 2005, 2010 and 2015–16; wildfires have become more common as Amazonia experiences droughts: it is estimated that forest fires now produce around 1.5 GtC per year.

Example answer: Amazonia is an enormous carbon store – it is estimated that its trees and soil store 200 GtC, and absorb around 2.2 GtC per year, with photosynthesis rates being extremely high at the canopy, and much lower at the forest floor, due to the dense canopy blocking much of the sunlight. Natural carbon emissions are very large – an estimated 1 GtC from decomposition of dead trees and leaf litter.

Deforestation is a major cause of changes to carbon stores in Amazonia, as it reduces the role of the tropical rainforest as a carbon sink. The burning of forests that takes place to clear land for farming releases carbon into the atmosphere.

Since 2000, Amazonia has lost 20.3 per cent of its original forest (832,000 km2), 70 per cent of which has been cleared for cattle ranching.

Severe droughts occurred in 2005, 2010 and 2015–16 and are more common now than in the past, which also increases the prevalence of wildfires. It is estimated that forest fires now produce around 1.5 GtC per year. Between 2010 and 2020, emissions have increased by 20 per cent, and it is now estimated that Amazonia emits more CO2 than it sequesters.

15 AO1 – Knowledge and understanding of changes in the carbon cycle over time. Knowledge and understanding of the role of feedback within and between cycles and their link to climate change. Knowledge and understanding of human interventions in the carbon cycle.

AO2 – Application of knowledge and understanding to assess the extent to which reducing carbon emissions is more important than adapting to the impacts of climate change.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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.



		• AO1 – 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.
3	11–15	 AO2 – 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.
		 AO1 – 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.
2	6–10	AO2 – 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.
		 AO1 – 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.
1	1–5	 AO2 – 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.
		 AO1 – 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.
0	0	 Nothing worthy of credit.



- Changes in the carbon cycle over time, to include natural variation (including wildfires, 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.

AO2

- Answers should discuss measures to reduce carbon emissions into the atmosphere against efforts to adapt to the impact of climate change.
- In terms of the reduction of carbon emissions, answers could refer to afforestation and reforestation, carbon capture and storage, direct air capture, enhanced rock weathering, carbon farming and other measures that aim at reducing the amount of carbon emitted from human activities that reaches the atmosphere.
- In evaluating reducing carbon emissions, answers could consider the scale of such reductions, the time required to make an impact, the cost and sustainability of such measures and their impact on factors such as, for example, food security.
- Adaptation measures may be drawn from other areas of study such as desertification, coastal sea level rise and coastal erosion management or management of cold environments.
- In evaluating adaptation, answers could refer to the feedback loops that may intensify the rate and impacts of climate change faster than adaptation measures can keep up with, with the implications of this for life on Earth.
- Answers can be argued either way, though the conclusions reached should be based upon preceding content.

16 AO1 –Knowledge and understanding of a chosen case study of a river catchment.

AO2 – Application of knowledge and understanding to assess impacts of precipitation on drainage basin stores and transfers and implications for sustainable water supply and/or flooding. AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11-15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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. AO1 – 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.
0	0	Nothing worthy of credit.

• Case study of a river catchment(s) at a local scale to illustrate and analyse the key themes above, engage with field data and consider the impact of precipitation upon drainage basin stores and transfers and implications for sustainable water supply and/or flooding.



- Drainage basins as open systems inputs and outputs, to include precipitation, evapotranspiration, and runoff; stores and flows, to include interception, surface, soil water, groundwater and channel storage; stemflow, infiltration overland flow, and channel flow. Concept of water balance.
- 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.

- Answers should apply knowledge of factors affecting water supply or flooding in a chosen case study of a river catchment and the impacts of human activities.
- Stores within the drainage basin include groundwater, soil moisture, vegetation (interception store), river and stream channels and surface storage (e.g. puddles, marshes, lakes).
- Factors affecting the impact of precipitation on stores and transfers include drainage basin size, drainage density, slope angle, rock type, antecedent conditions (e.g. soil saturation), extent and type of vegetation cover, intensity of rainfall.
- (if answering for flooding) Human activities can both increase flooding risks (e.g. by reducing stores, increasing flows) or reduce them.
- (If answering for sustainable water supply) Human activities can both reduce sustainable water supply (e.g. by increased abstraction, reduction in EVT through deforestation) and increase sustainability (e.g. by increasing store capacity).
- Interventions can include tree planting (to increase interception and infiltration and to reduce overland flow), changing farming techniques to increase infiltration into the groundwater store, building dams to reduce the 'flashiness' of drainage basin responses to storm events (overland flow), creation or extension of floodplains to reduce channel flow and increase infiltration.
- Assessment of the role of these inventions should be in the context of a chosen case study. For example, the Pickering 'Slowing the flow' project, with its aim to reduce the risk of flooding in Pickering from 25 per cent to 4 per cent, through creation of 'leaky dams' in channels and dams made of heather bales to smaller streams, blocking of moorland drains, 30 hectares of woodland being planted along the river, buffer zones on moorland, where burning of heather vegetation is banned. Success of the scheme in terms of a 20 per cent reduction in flood risk in Pickering.
- **17** AO1 Knowledge and understanding of feedback systems in the carbon cycle over time. Knowledge and understanding of the implications of climate change for life on Earth.

AO2 – Application of knowledge and understanding to assess the relative importance of feedback systems compared to other causes of climate change.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	• AO2 – 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.
		• AO1 – 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.
2	6–10	• AO2 – 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.
		 AO1 – 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.
1	1–5	AO2 – Very limited and/or unsupported evaluative conclusion that is loosely
		based upon knowledge and understanding which is applied to the context of the
		guestion. 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.
		• AO1 – 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.
0	0	Nothing worthy of credit.



- 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.
- Changes in the carbon cycle over time, to include natural variation (including wildfires, 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.

AO2

- Explanation of feedback systems (loops) and their implications for driving change in carbon stores; differentiation between positive (amplifying a change) and negative feedback (counteracting or reducing a change).
- Example of a positive feedback loop: carbon in permafrost decomposes as it thaws and is released into the atmosphere as CO₂ and CH₄, increasing the enhanced greenhouse effect and the amount of permafrost melting, further depleting carbon stored in the soil and increasing the magnitude of carbon stores in the atmosphere.
- Example of a negative and then positive feedback loop: warmer oceans increase their ability to absorb CO₂ from the atmosphere a negative feedback loop. However, more dissolved CO₂ increases seawater acidity, which can be harmful to corals and shellfish that build shells or skeletons from calcium carbonates, reducing their capacity to act as carbon sink, reducing the ocean's role in sequestering carbon (reducing the magnitude of this store) a positive feedback loop.
- Example of a negative feedback loop: increased CO₂ levels stimulating plant growth, leading to greater carbon absorption through more photosynthesis, increasing the magnitude of the biomass store.
- **18** AO1 Knowledge and understanding of systems in physical geography; knowledge and understanding of changes in the water cycle over time.

AO2 – Application of knowledge and understanding to assess the value of systems-based understanding compared to other forms of analysis.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.



3	11-15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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
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U	U	 Nothing worthy of credit.

- The water cycle and drainage basins as systems inputs and outputs, to include precipitation, evapotranspiration, and runoff; stores and flows, to include interception, surface, soil water, groundwater, and channel storage; stemflow, infiltration overland flow, and channel flow. Concept of water balance.
- Runoff variation and the flood hydrograph.



• Changes in water cycle inputs over time to include natural variation including storm events, seasonal changes and human impact on inputs including farming practices, land use change and water abstraction.

AO2

- Explanation of the global water cycle as a closed system; explanation of drainage basin as an open system with inputs of precipitation, solar radiation and via infiltration and runoff.
- Factors which could contribute to changes in input: climate change.
- Stores within the drainage basin (groundwater, soil moisture, vegetation, river and stream channels and surface storage) and how they respond to changing inputs.
- Flows within the drainage basin system include stemflow, throughfall, overland flow, throughflow and groundwater flow, and how they respond to changing inputs.
- Value of systems approach in terms of insights it gives into how a drainage basin will respond to changing inputs, e.g. factors increasing flood risk within a catchment and ways in which those could be influenced, e.g. planting trees, expanding, or developing floodplains.
- Limitations of a purely systems-based response could be made in relation to other aspects of the course, e.g. in relation to hazard management, people's perception of risk, economic costs, and benefits of different approaches, etc.

19 AO1 – Knowledge and understanding of the concept of the water cycle; knowledge and understanding of ecosystem responses to changes in one or more of their components or environmental controls; knowledge and understanding of a case study of a specified region experiencing ecological change.
 AO2 – Application of knowledge and understanding to assess the influence of different processes driving change in the water cycle within a tropical rainforest.

AUI	= 10	AO2 =	= 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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
3	11–15	 AO2 – 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.



		 AO1 – Generally clear and relevant knowledge and understanding of place(s) and environments.
		 AO1 – Generally clear and accurate knowledge and understanding of key
		concents, processes and interactions and change
		 AO1 – Generally clear awareness of scale and temporal change which is
		integrated where appropriate.
2	6–10	 AO2 – Some sense of an evaluative conclusion partially based upon knowledge
		and understanding which is applied to the context of the question.
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		partially relevant analysis and evaluation in the application of knowledge and
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		 AO1 – Some awareness of scale and temporal change which is sometimes
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		based upon knowledge and understanding which is applied to the context of the question. Interpretation is basic.
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		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.
0	0	 Nothing worthy of credit.

- Changes in the water cycle over time to include natural variation including storm events, seasonal changes and human impact including farming practices, land use change and water abstraction.
- The 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.
- Factors influencing the changing of ecosystems, including climate change and human exploitation of the global environment.
- 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.



- Discuss the water cycle and the different processes driving change in the water cycle (likely within a drainage basin context).
- Discuss long-term and short-term influences responsible for changes in tropical rainforest ecosystems, with reference to changes in the water cycle.
- Using case study details of land use changes, assess influence of different processes, likely comparing gradual nature of long-term influences compared to rapid nature of anthropogenic climate change.

20 AO1 – Knowledge and understanding of feedback systems in the carbon cycle over time. Knowledge and understanding of human interventions designed to mitigate the impacts of climate change.
 AO2 – Application of knowledge and understanding to assess the relative importance of feedback systems compared to other factors in climate change in informing our interventions to mitigate the impacts of climate change.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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.



1	1–5	 AO2 – Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts. AO1 – 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. AO2 – 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. AO1 – Very limited relevant knowledge and understanding of place(s) and
		 AO1 – 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.
0	0	 Nothing worthy of credit.

- Human interventions in the carbon cycle designed to influence carbon transfers and mitigate the impacts of climate change.
- 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.
- Changes in the carbon cycle over time, to include natural variation (including wildfires, volcanic activity) and human impact (including hydrocarbon fuel extraction and burning, farming practices, deforestation, land use changes).

- Consider the link between positive feedback systems and the challenges of monitoring the rate of climate change. For example, fresh snow and ice reflect a lot of sunlight (a high albedo). The rise in global temperatures causes ice caps and glaciers to melt. Less ice cover means less sunlight is reflected, and more heat is absorbed by the oceans and land, increasing global temperatures, causing further ice melting. Without an understanding of this feedback loop, the prediction and monitoring of associated climate change impacts, such as sea level rise, would be inaccurate and would hamper attempts to mitigate their effects, such as shifting coastal populations.
- Feedback loops also help to influence where mitigation efforts should focus. For example, afforestation and reforestation are mitigation measures designed to increase the absorption of carbon dioxide by trees and shrubs. However, if positive feedback systems linked to past deforestation have already had the impact of a drier local climate and increased risk of drought, then reforestation or afforestation may have limited success.



- Some interventions in the carbon cycle, e.g., enhanced rock weathering in which high-silica rocks such as basalt are crushed and spread over land, would lock away CO₂ from the air into calcium carbonate, and move that through water infiltration into the soil store and groundwater. However, it is not known what the impact of such actions would be on the carbon cycle: would impacts on feedback systems have unintended consequences?
- A relevant example could be how warmer oceans increase their ability to absorb CO₂ from the atmosphere

 a negative feedback loop but then more dissolved CO₂ increases seawater acidity, which can be
 harmful to corals and shellfish that build shells or skeletons from calcium carbonates, reducing their
 capacity to act as carbon sinks, reducing the ocean's role in sequestering carbon a positive feedback
 loop.
- Answers are likely to include that an understanding of feedback systems will be critical to informing our interventions in the carbon cycle to mitigate the impacts of climate change.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 2

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–6 are point-marked. Allow 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Deflation is one process by which wind removes loose surface materials (1) such as sand, silt, and clay from the desert's surface (1).
 - Abrasion is a second process of wind erosion in which wind-borne particles act as abrasive tools (1), wearing down exposed rock surfaces over time (1).

Example answer: Wind plays a significant role in redistributing sediment and also in aeolian landform development where there is scant vegetation and limited water. Deflation is the process of the wind removing loose surface materials such as sand, silt, and clay, leaving behind courser fragments, creating a desert pavement. Abrasion is when particles blown by the wind can act as an abrasive tool wearing down exposed rock surfaces over time.

- **2** AO1 = 4
 - Sediment sources include weathering, mass movement (rock falls, talus creep, soil creep), sediment washed by surface runoff, transported by rivers, and carried by wind (1 + 1).
 - Some sources of sediment may be from outside the desert (1), e.g. wind-blown sediment and sediment from mountain ranges carried into deserts by exogenous rivers (1).
- **3** AO1 = 4
 - Smaller leaves or spines instead of leaves (1)
 - Thick waxy cuticle (1).
 - Deep root systems (1).
 - CAM photosynthesis (1).
- **4** AO1 = 4
 - A sediment budget as the balance between the input, output, and storage of sediment within a desert system over a given period of time (1).
 - Concept of sediment inputs: low in deserts because of the very limited erosion of hillslopes by water (1).
 - Concept of transfers: wind erosion as the usual dominant transfer, though flash flooding as infrequently important (1).
 - Concept of sinks: desert sinks as localised and dynamic (e.g. dunes) because of lack of vegetation and surface water (1).
 - Concept of outputs: outputs often minimal, because of the lack of rivers to transport sediment out of the system (1).



5 AO1 = 4

- Geomorphological processes weathering, mass movement, erosion, transportation, and deposition (1).
- The role of wind:
 - erosion deflation and abrasion
 - transportation suspension, saltation, surface creep
 - o deposition (1).
- Sources of water exogenous, endoreic, and ephemeral; the episodic role of water (lake or oasis, salt pan) (1).

The following could also be mentioned and credited, up to a total of 4 marks:

- Sources of energy insolation, winds, runoff (1).
- Geology influence of rock type, differential erosion, tectonics (1).
- Time including influence of (different) past climates (1).

Points relating to a combination of factors also to be credited.

6 AO1 = 4

- Positive feedback as something that amplifies or reinforces changes; natural process in desertification (a process in which semi-arid regions become increasingly dry and lose vegetation cover) that human actions also influence and reinforce. [1 + 1]
- Example of process: reduced rainfall leads to loss of vegetation cover, loss of vegetation cover increases albedo, increased albedo disrupts convection currents, so rainfall decreases; regions become drier (2).
- Or alternative example: increased albedo disrupts convection currents, so rainfall decreases; regions become drier; drier, unprotected soils are more easily eroded, losing nutrients; infertile soils cannot support plant life, even if precipitation increases (2).

Questions 7–20 are level-marked.

AO3 – Analysis of the water balance data to identify patterns, anomalies and using data manipulation to support response.

AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.
		 Clear connection(s) between different aspects of the evidence.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- Figure 1 shows the water budget for Baghdad; soil water recharge occurs only in January and half of February; soil water is then only available for use by vegetation until the end of April. By then, all soil water has presumably evaporated or been transpired by vegetation.
- Adding up the monthly rainfall totals gives an annual precipitation amount of around 120–150 mm Baghdad is located in an arid zone.
- June to September is a dry season, with no recorded precipitation. Rainfall is concentrated in winter months.



- The high rates of PET (potential evapotranspiration) indicate high temperatures in the summer months.
- For most of the year, PET greatly exceeds P (precipitation), creating a large water deficit. Answers could estimate the aridity index (AI = P/PET) for Baghdad.
- The implication of the water balance for vegetation in Baghdad is that vegetation may be ephemeral (growing and reproducing only in the early spring), have adaptations for storing water (e.g. succulence) or tapping into deep groundwater stores, or be artificially irrigated.

Example answer: The water balance is the balance between inputs and outputs over a period of time, and is calculated using the formula P = O + E +/- S. Figure 1 is useful for an investigation into water balance in the location shown (Baghdad) in that it includes data for P (precipitation) and E (evapotranspiration), but limited in that total runoff data is not included. This is not too significant a limitation however since for most months the lack of rainfall means zero runoff can be inferred. S in the equation is changes in total water storage and this can be inferred as the difference between mean PET and mean monthly rainfall. Figure 1 shows that except for the end of December to mid-February, PET greatly exceeds P (precipitation) throughout the year, creating a large water deficit. This would provide highly useful data therefore for an investigation into water balance in this location.

8 AO3 – Analysis of the data showing the global aridity index in 2100 to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

- Identification of areas with a projected increase in aridity (lower aridity index (AI) values): South America (Amazonia region), central China, Europe, North America, as well as southern and western Africa and Australia.
- Identification of areas with projected decrease in aridity (higher AI values): at least four large regions: East Africa, India/South Asia, north-east Russia, Indonesia (Brunei/northern Borneo and Papua).
- Most hot deserts show stability or only minor change in aridity, e.g. central Sahara and Sahel show slight reduction in AI. An anomaly is the Atacama Desert, which shows an increase in AI.
- In Africa and Asia, the reduction in AI occurs broadly in the northern tropics, between the Equator and Tropic of Cancer. However, in the Americas this pattern is not evident; instead, an increase in AI occurs in the northern tropics.
- Answers might refer to variations in atmospheric circulation (position of the Inter-Tropical Convergence Zone (ITCZ), monsoon patterns) and ocean currents (intensification of ENSO – El Niño-Southern Oscillation).
- 9 AO3 Analysis of the solar radiation and water deficit data in Namibia data to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6



Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

- There is some evidence of a positive correlation between the two data sets, e.g. solar radiation is lower along the South Atlantic coast of Namibia, and water deficit is also lower along this coast.
- A water deficit is a negative water balance (precipitation minus evaporation): all the values for Namibia show a deficit, from less than 1300 mm to over 2500 mm, so the values are relative. A correlation between lower solar radiation and lower water deficit here is likely to be related to the cooling influence of the ocean, and perhaps lower radiation due to fog or clouds by the coast.
- Elsewhere, a negative correlation between solar radiation and water deficit is suggested. Solar radiation is higher in the north of Namibia than the south and increases towards Namibia's interior, while water deficit is higher in the south and lowest in the north and reduces inland along Namibia's border with Angola.
- Factors affecting solar radiation include latitude, and the observed north-south pattern matches this, with higher solar radiation values closer to the equator. The expectation would be that higher solar radiation values would correlate positively with higher water deficit, so other factors must be contributing to Namibia's water deficit pattern. Water deficit is measured by precipitation minus evaporation, so perhaps evaporation is increased in Namibia's southern interior by factors such as land surface type, longer hours of sunshine (fewer clouds) or relief.
- **10** AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of mid and low latitude deserts.

AO2 – Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of these landforms.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

A01

• Geomorphological processes: weathering, mass movement, erosion, transportation, and deposition.



- Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block and granular disintegration).
- Origin and development of landforms of mid and low-latitude deserts
 - aeolian deflation hollows, desert pavements, ventifacts, yardangs, zeugen, barchans and sief dunes
 - o water wadis, bahadas, pediments, playas, inselbergs.

- AO2 marks will come from recognising the importance of exfoliation as a process of mechanical weathering relating to, in hot deserts, the wide range in temperatures between hot days and cold nights.
- Answers should relate this to the spheroidal formation of the 'corestones', the cracks on their surface and the evidence of thin slightly curved sheets of debris around the landforms.
- Answers should explain how, in rocks with layers of different mineral compositions, outer layers expand more in the day, while the inner layers remain cooler. At night, outer layers contract more than the inner layers, resulting in the peeling away of thin sheets or slabs from the rock surface.
- Some answers may note that this region of Kazakhstan experiences freezing winter conditions, which may influence weathering processes, but very low precipitation, meaning that the majority of weathering is likely to be from thermal expansion and contraction.
- The lack of water is likely to mean little contribution from chemical weathering to the formation of the landscape, though this may have been significant during past wetter climate conditions.
- **11** AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of mid and low latitude deserts.

AO2 – Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of this landscape.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

A01

- Geomorphological processes: weathering, mass movement, erosion, transportation, and deposition.
- Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block and granular disintegration).
- Origin and development of landforms of mid and low latitude deserts:



- aeolian deflation hollows, desert pavements, ventifacts, yardangs, zeugen, barchans and sief dunes
- water wadis, bahadas, pediments, playas, inselbergs.

- Responses should note that the image shows zeugen and discuss the importance of wind erosion through abrasion in their formation. These features are most typically found in arid environments where there are strong, uni-directional winds and where a harder rock layer overlays less-resistant rocks.
- The image shows evidence of an overhang, and the note provides the information that this is likely to be a more resistant layer of limestone. Underneath it, the less-resistant chalk shows signs of wind erosion through abrasion: smooth, streamlined surfaces.
- The landforms are wider at the base and then narrow towards the top, before the overhanging caprock is reached, suggesting perhaps that saltation is not the dominant form of transportation of sediment, or that the chalk layer is more resistant at its base. Joints in the bedrock may be present, which could also explain the differential erosion within the less-resistant chalk.
- Sources of sediment are not immediately evident. Around the landforms, the ground appears to be covered by fragments of limestone caprock which have collapsed as the chalk has been eroded away; possibly however this is the exposed and eroded second layer of limestone between which the chalk is sandwiched.

12 AO1 – Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of mid and low latitude deserts.

AO2 – Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of this landscape.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

A01

- Geomorphological processes: weathering, mass movement, erosion, transportation, and deposition.
- Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block, and granular disintegration).
- Sources of water: exogenous, endoreic, and ephemeral.
- The episodic role of water; sheet flooding, channel flash flooding.



- Origin and development of landforms of mid and low latitude deserts:
- aeolian deflation hollows, desert pavements, ventifacts, yardangs, zeugen, barchans and sief dunes
- water wadis, bahadas, pediments, playas, inselbergs.

- Responses should note that the image shows a bahada. The episodic role of water is a dominant factor in their formation.
- Change in relief is critical: bahadas form where a series of confined channels emerge from mountains onto a flat plain. Answers need to identify this key feature from the photo and relate it to the additional information provided in the note.
- Mechanical weathering is likely to be important in the mountain ranges, which may experience very cold night-time temperatures, contrasting with very hot daytime temperatures to cause thermal fracture and other forms of mechanical weathering. This weathering will supply large amounts of unsorted sediment.
- When high-velocity channel flash flooding from the mountain range meets the low-gradient plain, the water spreads out and loses energy. Deposition of coarse, heavy sediment occurs nearest the channel mouth. This accumulates over time, creating the fan apex. Sediment is sorted across the alluvial fan, with the finest, lightest sediment forming the lower, gently-sloping outer edges of the fan. Answers should relate this to the image by referencing the evident gradient of the alluvial fans making up the bahada, and the spreading pattern of the drainage network seen on the alluvial fans' surface.
- Bahadas form as alluvial fans spread out over time and coalesce.
- Answers are therefore likely to conclude that while water is likely to play a small role in the supply of sediment through weathering, the bahada in the landscape is formed almost entirely through the transportation and deposition of sediment so that sediment is sorted across each of the alluvial fans making up the landscape feature.
- **13** AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of mid and low latitude deserts.

AO2 – Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of these landforms.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.



- Geomorphological processes: weathering, mass movement, erosion, transportation, and deposition.
- Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block, and granular disintegration).
- Sources of water: exogenous, endoreic, and ephemeral.
- The episodic role of water; sheet flooding, channel flash flooding.
- Origin and development of landforms of mid and low latitude deserts:
 - aeolian deflation hollows, desert pavements, ventifacts, yardangs, zeugen, barchans and sief dunes
 - water wadis, bahadas, pediments, playas, inselbergs.

AO2

- Responses should note that the image shows a sand dune on an underlying sandy or rocky surface. The sand dunes are self dunes, but answers are likely to recognise barchan-like shapes among the lines of self dunes.
- Seif dunes require an abundant supply of sediment: fine, well-sorted sand. The note states that the sediment source in this case is the Orange River, which perhaps deposits large amounts of sediment as it flows through the Namib Desert due to high rates of evaporation.
- The underlying layer may be formed of coarser sand which is not easily entrained by wind, or is possibly reg (stony desert) over which the dunes accumulate and migrate.
- Seif dunes are formed by bidirectional winds while the wind mainly blows in one direction, it occasionally switches to another. As a result, a dune forms as wind blows from one direction, and is then elongated by the dominant wind direction into a line. This could explain why some of the dunes resemble barchans that have elongated into seif dunes.
- When the wind switches direction, it reshapes the dune, forming a new slip face or as seems to be the case in the photo, removing slip faces.
- The change in wind direction also piles sand up onto the dune, making it taller and wider. The prevailing wind then redistributes sand along the dune's length, making it longer and, it could be concluded, giving it the sinuous form seen in this photo.
- Answers are likely to conclude that wind is the dominant factor in the formation of this landscape, with sediment sources provided by the Orange River (not visible in the photo so presumably a distant source), in a system where the fine sand is constantly being reshaped in a landscape that is evidence of dynamic equilibrium in the hot desert system.

14 AO1 – Knowledge and understanding of the causes of desertification.

AO2 – Application of knowledge and understanding to assess extent to which desertification can be seen as a characteristic process of a natural system.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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.



		• AO1 – 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
		 ΔΩ1 – Detailed awareness of scale and temporal change which is well integrated
		where appropriate.
3	11–15	 AO2 – 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.
		 AO1 – 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.
2	6–10	AO2 – 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.
		 AO1 – 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.
1	1–5	AO2 – 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.
		 AO1 – 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.
0	0	Nothing worthy of credit.



 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.

AO2

- Answers should include a definition of desertification: a process in which semi-arid regions become increasingly dry and lose vegetation cover.
- Answers should recognise that the extent and distribution of deserts has changed in the past (e.g. last 10,000 years) because of natural climate change and desertification has therefore been a natural process.
- The process of desertification has occurred in response to natural positive feedback loops: reduced rainfall leading to loss of vegetation cover, loss of vegetation increasing albedo, increased albedo reducing rainfall, etc.
- However, answers are likely to recognise that rates of desertification have increased in recent decades as a result of human activities.
- These activities exacerbate and intensify natural feedback process, so, for example, increased livestock grazing reduces vegetation cover, increasing albedo, reducing rainfall, increasing desertification and so on.
- Human influences also extend outside the regional scale of desert and semi-arid environments, with climate change meaning that reduced rainfall and prolonged droughts are caused by anthropogenic carbon emissions rather than any natural cycles.
- Answers may therefore conclude that while desertification is a characteristic process of a natural system to an extent, the predominant causes in the contemporary context are anthropogenic: human mismanagement of arid and semi-arid environments at the local and regional scale, and anthropogenic climate change at the global scale.

Example answer: Desertification is the process whereby semi-arid regions become increasingly dry and lose vegetation cover, resulting in soil erosion by wind and rain and general degradation of the land. At the last glacial maximum 20,000 years ago, hot deserts were more extensive than they are today. This was followed by a warmer and more humid period, only reaching their present-day distribution and extent about 3000 years ago.

The extent and distribution of deserts has changed in the last 10,000 years, with little human influence, so desertification has therefore been a process of natural climate change.

The process of desertification has occurred in response to natural positive feedback loops: reduced rainfall leading to loss of vegetation cover, which increases albedo, reduces soil moisture and fertility of soils, leading to soil erosion and desertification. Arid and semi-arid soils are fragile – low in nutrients and organic matter because of low decomposition rates and sparse vegetation cover. Even if levels of precipitation increase, these infertile soils cannot sustain vegetation.

However, in recent decades, rates of desertification have increased as a result of human activities, which exacerbate and intensify natural feedback process. For example, increased livestock grazing in the Sahel on the southern fringes of the Sahara Desert also reduces vegetation cover, which increases albedo, which has the effect of reducing rainfall, increasing the risk of soil erosion, and increasing desertification. Population increase puts more pressure on changing land use for arable or pastoral farming, which requires irrigation. Subsequent evaporation of irrigated water for crops leaves behind mineral salts, leading to salinisation and soil degradation.

Human influences also extend outside the regional scale of desert and semi-arid environments, with anthropogenic carbon emissions, rather than any natural cycles, causing reduced rainfall and prolonged droughts.



While desertification is a characteristic process of a natural system to an extent, especially historical desertification, the predominant causes in the contemporary context are anthropogenic – human mismanagement of arid and semi-arid environments at the local and regional scale, and anthropogenic climate change at the global scale.

15 AO1 – Knowledge and understanding of the causes of desertification; knowledge and understanding of climate change.

AO2 – Application of knowledge and understanding to assess the impacts of climate change on desertification, using local scale case study.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
		integrated where appropriate. There may be a few maccuracies.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – 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.
0	0	Nothing worthy of credit.

- 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.
- The carbon budget and the impact of the carbon cycle upon land, ocean, and atmosphere, including global climate.
- 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.

- Answers should include a definition of desertification: a process in which semi-arid regions become increasingly dry and lose vegetation cover.
- Answers should recognise that natural climate change has been the driver for desertification for millennia, with the present-day distribution of deserts only dating to around 3000 years ago.
- However, answers are likely to note that the unprecedented rate of climate change resulting from human interventions into the carbon cycle is having, and will continue to have, significant impacts on desertification.
- Predictions are that 30 per cent of the Earth's surface will experience additional 'aridification' by 2050 if the global average temperature increase reaches 2°C. This can be cut by two thirds if temperature increase remains below 1.5°C. This shows the range of potential impacts on the extent and rate of desertification from different climate futures. Include predicted temperature increases from your desertification case study.
- Answers may consider that the impacts of climate change on desertification may vary spatially and over time. For example, if climate zones shift northwards, desertification will have different impacts from climate change leading to an increase in droughts within a region that already experiences cycles of drier



years. The impact of climate change can be exacerbated by events such as El Niño, with greater impacts in some years than in others. Include spatial changes to desertification from desertification case study, for example changes in monsoon rainfall patterns.

- Answers are also likely to conclude that other factors will be significant in intensifying or mitigating the
 impacts of climate. For example, human population increase in dryland areas or an increase in livestock
 numbers may increase the rate and extent of desertification more than in areas experiencing the same
 changes in climate but fewer human impacts. Link this to data on population growth from your
 desertification case study. Likewise, mitigation efforts may reduce the impact of climate change on
 desertification in some areas, but not in others.
- 16 AO1 Knowledge and understanding of the causes of desertification; knowledge and understanding of resilience, mitigation, and adaptation as human responses to desertification at a local scale.
 AO2 Application of knowledge and understanding to assess human responses to desertification.
 AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding of place(s) and environments. AO1 – 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 approximate.
0	0	 Nothing worthy of credit.
-	-	

- 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.
- 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.

- Answers should include a definition of desertification: a process in which semi-arid regions become increasingly dry and lose vegetation cover.
- Answers likely to consider mitigation as one of three main types of human response to desertification: mitigation, adaptation, and resilience. The aims of each should be briefly outlined.
- Mitigation strategies could be exemplified, with the same being done for resilience and adaptation.
- Case study knowledge or other examples could be used for the assessment of the different responses, considering advantages and disadvantages of different responses. For example, increased yields of up to 100 per cent following the introduction of zai planting pits in Burkina Faso (resilience).
- Evaluation could also consider responses at different scales and are likely to conclude that given the range of challenges caused by desertification at different scales, the absence of a one-size-fits-all solution means that a combination of all three responses will be better than a focus on one to the detriment of the other two.


17 AO1 – Knowledge and understanding of development geomorphological processes operating in hot deserts including both distinctively arid geomorphological processes, the role of wind and the episodic role of water.
 AO2 – Application of knowledge and understanding to assess whether historic, one-off events have a much greater influence than ongoing processes for landscape development in hot deserts.
 AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.



- Geomorphological processes: weathering, mass movement, erosion, transportation, and deposition.
- Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block and granular disintegration).
- The role of wind erosion: deflation and abrasion; transportation; suspension, saltation, surface creep, deposition.
- Sources of water: exogenous, endoreic, and ephemeral; the episodic role of water; sheet flooding, channel flash flooding.

AO2

- Answers should consider what might be meant by ongoing processes: i.e. the distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block, and granular disintegration).
- Link these ongoing processes to landforms where, typically, episodic events are not involved, for example landforms and landscapes predominantly influenced by thermal fracture, exfoliation and block and granular disintegration.
- Answers also likely to consider landforms and landscapes influenced predominantly by ongoing and prevailing winds, for example desert pavements, yardangs, zeugen and barchan dunes.
- Historic and one-off events could be taken to refer to episodic events such as flash flooding. Characteristic landforms and landscapes could then consider wadis, bahadas, pediments and playas.
- Answers could consider the importance of scale: ongoing processes are likely to be highly significant over a long time period. However, short-event, high magnitude, and large-scale events, such as a historic flood or historic tectonic event in a desert landscape may have far-reaching and extensive influence on landscape development.
- **18** AO1 Knowledge and understanding of the causes of desertification; knowledge and understanding of implications of desertification for sustainable development.

AO2 – Application of knowledge and understanding to assess the case for development of hot desert landscapes.



Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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.

		REVISE
		 AO2 – Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts. AO1 – 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.
0	0	Nothing worthy of credit.

- 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.
- Characteristics of hot desert environments and their margins: climate, soils, and vegetation (and their interaction). Water balance and aridity index.
- 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.

- Answers may consider the question from a range of perspectives, including economic, social, and environmental.
- From the environmental perspective, answers are likely to conclude that deserts and their margins are
 indeed fragile environments, with soils that are thin, lack nutrients, organic material and structure, and
 which are therefore very easily eroded by wind or water; plants that can survive in desert landscapes can
 do so usually because they are highly adapted xerophytes and halophytes and, as such, are typically
 slow-growing and vulnerable to damage and change.
- From the environmental perspective also, recent history has shown how rising human populations in arid and semi-arid regions intensify the natural feedback systems that lead to desertification the development of these regions for increased livestock farming, for example, or crop growing has tended to intensify the rate of desertification. Examples of desertification linked to increased development could be given here.
- From the economic perspective, the development of hot deserts and their margins can often be considered a success: e.g. hot deserts offer unparalleled opportunities for solar energy generation, which can take place regardless of the fragility of desert soils, plants, or animals. Hot desert locations are popular places for tourism and for settlement, as long as the society has the resources to bring in the water required for, say, swimming pools and lawn sprinkler systems. However, the sustainability of this type of development could be questioned.
- From the social perspective, people have lived sustainably in hot deserts and their margins for many thousands of years. Answers might consider the impact of development on their 'fragile', highly adapted lifestyles and traditions, but also how the successful adaptations these cultures have made to desert living can be the source of adaptations and solutions to sustainable development of deserts and their margins today.



19 AO1 – Knowledge and understanding of the causes of desertification; knowledge and understanding of implications of desertification for sustainable development.

AO2 – Application of knowledge and understanding to assess the case for development of hot desert landscapes.

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.



- 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.
- 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.

- Answers should define desertification and consider the impacts that desertification has on ecosystems, populations, and climate systems, e.g. ecosystem degradation, soil erosion, drought and water scarcity, loss of livelihoods, human displacement and migration, and climate change.
- Answers should consider the impacts of desertification on the physical landscape, e.g. gullying, loss of topsoil and increased extent of or formation of sand dunes. Impacts can also include the increased vulnerability of degraded landscapes to extreme weather events such as droughts and floods.
- The impact of human activities in these changes could be related to specific landscapes, e.g. the Sahel (e.g. Burkina Faso) where a high rate of population growth is increasing the extent and rate of desertification due to the increased pressures of more people and their livestock on the land.
- The impact of human activity varies, and this variation happens at different scales: this could be an angle of the question that answers could explore, perhaps in relation to landscapes in which desertification is happening primarily because of human activity at the global scale (climate change) rather than locally, or a landscape where desertification happened in the distant past before human activity was a factor.
- The impact of human activity could also be in response to desertification: human responses of mitigation, resilience, and adaptation. Answers could use case study information here to describe the impacts of schemes to, for example, reforest semi-arid areas or use bunds or dams, or zai pits to reduce soil erosion and fill in gullies.



20 AO1 – Knowledge and understanding of distinctively arid geomorphological processes: weathering and erosion.

AO2 – Application of knowledge and understanding to assess the relative importance of weathering and erosion in the development of hot desert landscapes.

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.



- The relationship between process, time, landforms, and landscapes in mid and low latitude desert settings: characteristic desert landscapes.
- Distinctively arid geomorphological processes: weathering (thermal fracture, exfoliation, chemical weathering, block, and granular disintegration).
- The role of wind:
- erosion deflation and abrasion
- transportation suspension, saltation, surface creep
- deposition.
- Sources of water exogenous, endoreic, and ephemeral.
- The episodic role of water sheet flooding, channel flash flooding.

- Answers are likely to outline weathering processes in hot desert landscapes: thermal fracture, exfoliation, chemical weathering, block, and granular disintegration.
- Landforms of weathering could be exemplified at this point as an indication of hot desert landscapes where weathering predominates.
- Answers are likely to outline erosion processes related to wind and water: deflation and abrasion; transportation; suspension, saltation, surface creep, deposition.
- Landforms of erosion by wind and by water could be exemplified at this point as an indication of hot desert landscapes where different types of erosion predominate.
- Consideration is then likely to focus on the relative important of weathering and of erosion in the development of hot desert landscapes: the relationship between process, time, landforms, and landscapes.
- Answers may discuss weathering as a key criterion in preparing rock surfaces for erosion: perhaps concluding that erosion depends on weathering, making it relatively more important. This might be given nuance by consideration of time, some weathering of hot desert landscapes having taken place in eras when climate conditions were wetter, for example.
- Answers should consider how different processes may dominate in different areas of a hot desert, perhaps due to wind strength and/or direction, rock type, presence or absence of water, tectonic activity, sediment sources and sources of energy, including insolation.



• Answers are likely to conclude that it is not possible to say that either weathering or erosion always predominate in the development of a hot desert landscape, but that this landscape is itself the result of interactions between these processes and geology over time.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 3

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–8 are point-marked. Allow 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Wind creates waves when it blows over the surface of the sea (1). The friction causes the particles to rotate (1).
 - Wind determines wave energy, as wave energy is influenced by wind speed, duration, strength, and the length of fetch (1).
 - The energy of the waves can influence the processes and landforms found in the coastal environment (1).
 - A high-energy environment is characterised by powerful, destructive waves and high rates of erosion (1).
 - Destructive waves have a backwash which has more energy than the swash and will remove material from the beach (1).
 - Low-energy environments have a higher rate of deposition due to less powerful, constructive waves for most of the year and are more likely to be sandy and estuarine coasts (1).
 - Constructive waves have a swash which has more energy than the backwash and will build up a beach (1).

Example answer: Wind creates waves when it blows over the surface of the sea, as the friction causes the particles to rotate. Wind speed, duration, strength, and the length of fetch will determine the wave's energy. The energy of the waves can influence the processes and landforms found in the coastal environment. A high-energy environment is characterised by powerful, destructive waves and high rates of erosion. Low-energy environments have a higher rate of deposition due to less powerful, constructive waves for most of the year and are more likely to be sandy and estuarine coasts.

2 AO1 = 4

- The impact of erosional processes is influenced by the type of wave (destructive waves have more erosional power) (1) and rock type (weaker rocks are more susceptible to erosion) (1).
- The processes of marine erosion are:
 - Hydraulic action waves force air into the cracks in cliffs. The compressed air bubbles create a mini explosion (cavitation) (1). The repeated increase in pressure will force cracks to widen and break pieces off the cliff (1).
 - Solution a chemical process where limestone is dissolved by carbonic acid in seawater (1). It is the only erosional process which is not more effective under storm conditions (1).
 - Abrasion/corrasion sediment that is carried by the waves is thrown at the cliffs and wears the cliff face away (1).
 - Wave quarrying the removal of loosened material by wave action (1).
 - Attrition pieces of sediment that are carried in the waves knock against each other, breaking parts of the rock down and creating smoother, smaller and rounder particles (1).
- Marine erosion is responsible for the creation of distinctive coastal landforms (1), such as cliffs, wave-cut platforms, and cliff profile features such as stacks (1).
- Coastal erosion will also contribute to the retreat of coastlines (1).



- **3** AO1 = 4
 - Waves attack cliffs between the high- and low-tide marks (1); marine erosion creates a wave-cut notch (1).
 - Continued undercutting creates an overhang (1).
 - The unsupported overhang eventually collapses (1), and the cliff retreats (1).
 - Fallen debris is removed from the base of the cliff by wave action (1).
 - A wide, gently sloping platform is left behind at the base of the cliff which is covered at high tide (1). The cliff has retreated from its previous position (1).

4 AO1 = 4

- Longshore drift transports sediment along the coastline, in the direction of the prevailing wind (1).
- When the coastline changes direction, due to a bay, estuary or indent, longshore drift continues to carry material out into the open sea (1).
- Sediment is deposited and this process continues until the sediment is visible above the water line (1).
- A secondary wind, or a change in wave direction, can create a recurve at the distal end, creating a compound spit (1).
- The area behind a spit is sheltered, and pioneer species may establish there, creating a salt marsh (1).

5 AO1 = 4

- Mudflats and saltmarshes develop in areas with low wave energy and shelter, such as estuaries, bays, and behind spits (1).
- For example, Keyhaven salt marshes have formed behind Hurst Castle spit on the UK's Hampshire coastline (1).
- Fine, suspended sediment forms into clumps which are deposited between high and low tide levels (1).
- The first plants to grow in saltmarshes are small pioneer plants and algae (1). Both help to bind the mud and clays together and trap sediment (1).
- Halophytes (salt-tolerant plants) establish themselves next and decompose, adding organic matter to the soil (1).
- Over time, a wider variety of plants will be able to survive in the saltmarsh, reducing the wave action further and encouraging more deposition (1).

6 AO1 = 4

- Isostatic factors lead to a local change in the land level, leading to a relative change in sea level (1).
- Land can subside due to the weight of the ice stored on it, leading to a relative sea level rise (1).
- Land that was once covered in ice during the last ice age is still rising and falling in a process called glacial isostatic adjustment (1).
- A high rate of deposition within a sediment cell may increase the level of the land, leading to a relative sea level fall (1).
- Tectonic processes, such as volcanic activity on the seafloor or subduction zones, can displace the ocean and lead to sea level change (1).

7 AO1 = 4

- Waves attack geological weaknesses in a headland, such as joints and cracks (1).
- These geological weaknesses are eroded easily and widen and deepen to form a cave (1).
- Back-to-back caves eventually join and break through the headland to form an arch (1).
- Continued marine erosion at the base of the arch and subaerial processes on the roof cause the arch to collapse (1).
- A tall, isolated pillar of rock, a stack, stands separate from the headland, which has retreated (1), e.g. The Twelve Apostles are a collection of limestone stacks in Victoria, Australia (1).



• Erosion at the base of the stack can create a notch (1) which is unable to support the weight above, so the stack collapses to form a stump which may only be visible at low tide (1).

Questions 9–17 are level-marked.

8 AO3 – Analysis of the data evidence of predicted sea level rise in three different scenarios to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.

- Global sea level will vary globally but with no clear pattern.
- Most areas will experience regional mean sea level rise (pink/red areas).
- The highest levels of sea level rise will occur between 2081 and 2100 (the darker red colour).
- RCP 8.5 shows the highest level of sea level rise for most regions in both time periods.
- The range of sea level change for all RCPs across both time periods is 2.4 metres.
- Some areas show regional sea level falling, e.g. north-east of Canada and Greenland. This fall will be the most significant for RCPs 2.6 and 4.5 between 2081 and 2100 (the darker blue).
- Land areas may have been better shown in a different colour, as it is difficult to differentiate between them and the areas of zero mean level change.

Example answer: The maps show future sea level change will vary globally but most areas will experience regional mean sea level rise. There is no clear pattern for where sea level change is higher or lower. The highest levels of sea level rise will occur between 2081 and 2100. RCP 8.5 shows the highest level of sea level rise for most regions in both time periods. The range of sea level change shown across all maps is 2.4 metres. Some areas will experience a regional sea level fall, specifically in the north-east of Canada and in Greenland. This fall will be the most significant for RCPs 2.6 and 4.5 between 2081 and 2100. it is not clear whether the white areas are land areas, or 0 metres mean sea level change.

9 AO3 – Analysis of the data evidence of the average rate of cliff retreat in California to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support. Basic connection(s) between different aspects of the evidence.



- The map shows variation in the rate of cliff retreat along the California coastline over a 52-year period.
- Cliff retreat appears to be higher in areas of Franciscan Complex geology (0.20–0.25 metres per year), and is highest around the area of Big Sur.
- Cliff retreat appears to be lower in areas of granitic rocks (0.12 metres per year), in the northern part of the coastline.
- Study area 4 shows a higher rate of cliff retreat (0.22 metres per year) but, as the map shows the area is mainly granitic rock, there must be other factors influencing the higher rates of cliff retreat, other than geology.
- The map does not show evidence of other factors that may be influencing the rate of cliff retreat, such as management, impact of marine processes and presence of landforms.
- **10** AO1 Knowledge and understanding of the transportation processes related to the development of spits. AO2 – Application of this knowledge to the novel situation; specifically, in accounting for the formation of

spits.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

A01

- Origin and development of landforms and landscapes of coastal deposition spits; factors and processes in their development.
- Distinctively coastal processes: marine: transportation, traction, suspension (longshore/littoral drift) and deposition.

- Longshore drift transports sediment along the coastline, in the direction of the prevailing wind. Sediment within the waves travels by traction and suspension.
- When the coastline changes direction, due to a bay, estuary or indent, longshore drift continues to transport material out into the open sea.
- Sediment is deposited and this process continues until the sediment is visible above the water line.
- The spit in the photo has a curved end. A secondary wind, or a change in wave direction, can create a recurve at the distal end, creating a compound spit.



- There is considerable deposition of sediment behind the spit in the photo. The area behind a spit is sheltered, and pioneer species may establish there, creating a salt marsh.
- The spit in the photo has well-established vegetation, which has colonised the spit over many years helping to stabilise it.

Generic explanation of the formation of spits (with no attempt to apply knowledge to the resource and associated information) should be held to Level 1.

11 AO1 – Knowledge and understanding of the role of wave energy related to the development of coastal landscapes.

AO2 – Application of this knowledge to the novel situation; specifically, in accounting for the formation of coastal landscapes – bays, headlands and cliffs.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

A01

- Origin and development of landforms and landscapes of coastal erosion: cliffs and wave cut platforms, cliff profile features including caves, arches, and stacks; factors and processes in their development.
- Sources of energy in coastal environments: winds, waves (constructive and destructive), currents and tides. Low energy and high-energy coasts.

- There are several factors and processes that affect the development of coastal landforms and landscapes.
- The photo shows a bay, with a headland in the foreground and background a discordant coastline.
- Destructive, storm waves have more energy and lead to higher rates of erosion and cliff retreat.
- Constructive waves with less energy have deposited sediment in the bay creating the beach shown in the photo.
- The photo shows some steep cliffs with evidence of mass movement at the foot.
- The cliffs appear to be stabilised by vegetation growth.
- Geology will have affected the development of this landscape. Geology has two aspects, lithology (the geological structure of a rock), and rock type.
- Soft, sedimentary rocks are more susceptible to erosion and higher rates of coastal recession, whereas harder rock types, such as igneous and metamorphic, are less easily eroded and weathered.



- Joints and faults are fractures which create points of weakness in rocks, which are then vulnerable to
 weathering and erosional processes. They can be exploited to form wave-cut notches and caves in the cliff.
- Angle of dip may have affected the steepness of the cliff profiles. Steeper cliffs in the background may have rocks that dip towards the land.
- There is no evidence of human activity to manage this coastline, so it cannot be seen that management or development is affecting the natural processes which create this coastal landscape.

Generic explanation of the formation of coastal landforms such as bays, beaches, headlands, and cliffs (with no attempt to apply knowledge to the resource and associated information) should be held to Level 1.

12 AO1 – Knowledge and understanding of the role of vegetation related to the development of coastal landscapes.

AO2 – Application of this knowledge to the novel situation; specifically, in accounting for the formation of saltmarshes and mudflats.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

A01

- Estuarine mudflat/saltmarsh environments and associated landscapes; factors and processes in their development.
- Distinctively coastal processes: deposition.

- The photo shows a well-established saltmarsh. There are several factors and processes that affect the development of saltmarsh environments.
- Deposition occurs when waves lose their energy and drop the sediment that they are carrying.
- Mudflats and saltmarshes develop in areas with low wave energy, and shelter, such as estuaries, bays, and behind spits e.g. Keyhaven salt marshes have formed behind Hurst Castle spit on the UK's Hampshire coastline.
- Fine, suspended sediment forms into clumps which are deposited between high and low tide levels.
- The first plants to grow in saltmarshes are small pioneer plants and algae. Both help to bind the mud and clays together and trap sediment.
- Halophytes (salt-tolerant plants) establish themselves next and decompose to add organic matter to the soil. It appears that this is the stage that this saltmarsh has reached.



- Over time, a wider variety of plants will be able to survive in the saltmarsh, reducing the wave action further and encouraging more deposition.
- 13 AO1 Knowledge and understanding of the role of soft engineering and its protection from coastal erosion.
 AO2 Application of this knowledge to the novel situation; specifically, coastal protection.
 AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.

- Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk: hard and soft engineering.
- Sustainable approaches to coastal flood risk and coastal erosion management; shoreline management/integrated coastal zone management.

AO2

- The photo shows a cliff which appears vulnerable to sub-aerial processes of weathering and mass movement.
- There is a narrow beach which means that destructive waves will attack the base of the cliff.
- The geology of the cliff appears unstable.
- Soft engineering that could be used here includes beach nourishment, cliff regrading and drainage. There are no coastal ecosystems, such as salt marshes or sand dunes, to revegetate or stabilise.
- Cliff regrading and drainage involves reducing the angle of the cliff to lower the risk of mass movement and to drain water out.
- Cliff regrading and drainage removes part of the cliff, and overextraction of water can increase vulnerability of collapse.
- If beach nourishment is used, sediment is continually transported away so needs constant replenishing.
- The narrow beach and weak cliffs may benefit from hard engineering strategies, such as groynes to create wider beaches, or a sea wall to protect the cliffs from destructive waves.
- **14** AO1 Knowledge and understanding of the challenges for sustainable management of a coastline at a local scale.

AO2 – Application of knowledge and understanding to assess the challenges of sustainable management. AO1 = 10 AO2 = 10



Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
ω	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts.



		 AO1 – 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.
0	0	Nothing worthy of credit.

- Human intervention in coastal landscapes. Traditional approaches to coastal flood and erosion risk; hard and soft engineering. Sustainable approaches to coastal flood risk and coastal erosion management; shoreline management/integrated coastal zone management.
- Case study(ies) of coastal environment(s) at a local scale to illustrate and analyse fundamental coastal processes and their landscape outcomes as set out above and engage with field data and challenges represented in their sustainable management.
- Geomorphological processes: weathering, mass movement, erosion, transportation, and deposition.

AO2

- The Holderness coast in East Yorkshire runs from Flamborough Head in the north to Spurn Head in the south and experiences rapid coastal recession, around two metres a year.
- Rapid coastal recession is due to strong, destructive waves with a long fetch, soft and easily eroded geology, strong rip currents, lack of sediment accumulation on beaches and regular stormy weather.
- The predominant rock types are chalk (at Flamborough Head) and boulder clay (a mixture of rock material formed by the deposition of sediment carried by glacier), which are both soft and vulnerable to erosion.
- Transportation processes sediment is carried southwards, towards Spurn Head, by longshore drift, which prevents sediment accumulation on beaches, allowing for high rates of cliff erosion.
- There has been much conflict between local stakeholders over which areas should be protected.
- Sustainable management of coastlines involves being managed by a shoreline management plan (SMP). Each Plan is devised by local councils and the Environment Agency, with input from other organisations, and outlines a sustainable approach to managing the threats to the coastline over 100 years, as it works with natural processes and allows natural coastal change.
- It identifies the opportunities to improve the coastal environment, the best approach to defend coastal assets and manage risks, and the consequences of putting the management in place.
- Holderness has had a Shoreline Management Plan since 1998.
- Some areas of the coastline are protected from geomorphological processes the main settlements, Bridlington, Hornsea, Mappleton, and Withernsea, are protected by hard engineering, with a combination of sea walls, groynes, and rock armour. The gas terminal at Easington is also protected with a 1km long revetment.
- The gas terminal at Easington is also protected with a 1 km-long revetment.
- Groynes used in some areas of the coastline have led to sediment starvation and increased erosion southward.

Example answer: The geomorphological processes of erosion, weathering, transportation, and deposition present challenges for the sustainable management of the Holderness coast in East Yorkshire. The coastline from Flamborough Head in the north to Spurn Head in the south experiences rapid coastal recession, around two metres a year. The rapid coastal recession is due to high rates of erosion. The waves are strong, and destructive due to the long fetch and frequent stormy weather brought to the UK by mid-latitude low pressure systems. The predominant rock types are chalk (at Flamborough Head) and boulder clay (a mixture of rock



material formed by the deposition of sediment carried by glacier), which are both soft and vulnerable to erosion. Transportation processes are also presenting challenges, as sediment is carried southwards, towards Spurn Head, by longshore drift, which prevents sediment accumulation on beaches, allowing for high rates of cliff erosion.

Some areas of the coastline are protected from geomorphological processes. The main settlements, Bridlington, Hornsea, Mappleton and Withernsea, are protected by hard engineering, with a combination of sea walls, groynes, and rock armour. The gas terminal at Easington is also protected with a 1km long revetment. However, the groynes used in some areas of the coastline have led to barriers to transportation and has resulted in sediment starvation and increased erosion southward of the groynes. There has been much conflict between local stakeholders over which areas should be protected.

Sustainable management of coastlines involves being managed by a shoreline management plan (SMP). Each Plan is devised by local councils and the Environment Agency, with input from other organisations, and outlines a sustainable approach to managing the threats to the coastline over 100 years, as it works with natural processes and allows natural coastal change. Holderness has had a Shoreline Management Plan since 1998 to try to address the challenges caused by geomorphological processes.

On Holderness, it is not the geomorphological processes alone which are causing challenges for sustainable management. It is also the natural geology, the weather, and the existing choice of management of the area, which presents challenges. A combination of these factors, with the geomorphological processes which are acting on the coastline, are presenting the challenges of rapid coastal recession and coastline loss.

15 AO1 – Knowledge and understanding of the risks and opportunities for human occupation and development at a coastline beyond the UK.

AO2 – Application of knowledge and understanding to assess the risks and opportunities for human occupation and development.

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1-5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – 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.
0	0	 Nothing worthy of credit.

- Case study of a contrasting coastal landscape beyond the UK to illustrate and analyse how it presents risks and opportunities for human occupation and development and to evaluate human responses of resilience, mitigation, and adaptation.
- Sustainable approaches to coastal flood risk and coastal erosion management; shoreline management/integrated coastal zone management.



AO2

- The Odisha coastline is around 450 km long and found in north-east India. There are many depositional landforms along the coastal plain, including six large deltas. Chilika Lake is the largest brackish coastal lagoon in the world and is home to a number of threatened species, such as the Irrawaddy dolphin.
- The coastline is attractive for human settlement.
- There are large populations dependent on the coastline for resources, such as shrimp farming.
- Mangrove ecosystems provide fuelwood, land for reclamation, cultivation, and timber.
- Urbanisation, maritime transport, fishing, tourism, mining and offshore oil and gas production have led to resource exploitation.
- There are extreme tidal variations, frequent tropical cyclones and the area is at severe risk of sea level rise.
- Between 1990 and 2015, the shoreline receded 10–15 m/year which risks the livelihoods of the large population living along the coastline.
- Many countries use sustainable ICZM strategies to manage extended areas of the coastline within sediment cells. ICZM involves all stakeholders, taking their views and needs into account, ensures that approaches in one area of the cell do not have negative impacts elsewhere, ensures that management is long-term, sustainable and allows for economic development, and can change as the threats to coastal areas develop.
- The Government of India and the World Bank have created an ICZM to manage the coastline sustainably and balance the needs of all stakeholders.
- The ICZM promotes small-scale eco-tourism activities which offer employment for locals and sustainable income.
- Communities are trained to plant and protect mangroves, which are being replanted to improve coastal protection and reinstate habitats.
- Marine transport is being regulated and boats are being replaced with vessels that don't use diesel.
- Rehabilitation colonies have been set up to rehome displaced people whose villages have been submerged.

Credit any other valid approach. Evaluation should be based upon preceding content.

16 AO1 – Knowledge and understanding of the different factors responsible for the development of landscapes of coastal deposition.

AO2 – Application of knowledge and understanding to assess the different factors responsible for the development of landscapes of coastal deposition.

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.



3	11–15	AO2 – 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.
		• AO1 – 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.
2	6–10	AO2 – 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.
		 AO1 – 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.
1	1–5	 AO2 – 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.
		 AO1 – 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.
0	0	 Nothing worthy of credit.

- Origin and development of landforms and landscapes of coastal deposition. Beaches, simple and compound spits, tombolos, offshore bars, barrier beaches and islands and sand dunes; factors and processes in their development.
- Estuarine mudflat/saltmarsh environments and associated landscapes; factors and processes in their development.



- Distinctively coastal processes: transportation; traction, suspension (longshore/littoral drift) and deposition.
- Case study(ies) of coastal environment(s) at a local scale to illustrate and analyse fundamental coastal processes, their landscape outcomes.

AO2

- There are many factors responsible for the development of landscapes of coastal deposition such as deposition, transportation, wave energy, tides, weather events, vegetation, presence of rivers.
- Deposition occurs when waves lose their energy and drop the sediment that they are carrying.
- Coastal landscapes of deposition have a sediment budget which is experiencing losses of sediment.
- Beaches are a key feature of these landscapes as they are an accumulation of deposited sediment. There are found in a low-energy environment, which has a higher rate of deposition due to less powerful, constructive waves for most of the year.
- An offshore bar is a narrow ridge of sediment which runs parallel to the coast and is formed when backwash removes material from the beach and deposits it in the offshore zone.
- There are many factors which affect beach morphology: sediment type, wave energy, tides, and weather events.
- Spits are another feature of landscapes of coastal deposition. Spits are more common in areas with low tidal ranges.
- Spits which form across an estuary become cut off when the river current is too strong to allow deposition to continue.
- Blakeney Point in Norfolk is an example of a compound spit with many recurves.
- If a spit extends out to reach an island, it can join that island to the mainland, creating a tombolo, e.g. Tombolo di Orbetello in Italy, where three spits have linked the island of Monte Argentario to the mainland.
- If a spit extends out across a bay, it can connect to the headland on the other side and create a bar or barrier beach, with a lagoon of brackish water forming on the landward side.
- If the barrier beach becomes disconnected from the mainland, it forms a barrier island, e.g. the Friesian Islands in the Netherlands and Germany are Europe's biggest barrier island system.
- Vegetation also plays an important role in the development of landscapes of coastal deposition. Xerophytes and halophytes stabilise landforms such as sand dunes and salt marshes.
- Mudflats and saltmarshes develop in areas with low wave energy and shelter, such as estuaries, bays, and behind spits, e.g. Keyhaven salt marshes have formed behind Hurst Castle spit on the UK's Hampshire coastline.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 4

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–6 are point-marked. Allow 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Plucking is one process by which subglacial water freezes against bedrock (1) and then pieces of rock are 'plucked' from the bedrock as the glacier moves (1).
 - Water is also involved in freeze-thaw weathering (1), which weakens rock, making it more easily eroded by glacial or fluvioglacial processes (1).

Example answer: Plucking is an erosional process by which the glacial ice melts, possibly when there is increased pressure as the glacier moves over an obstacle, and then pieces of rock are 'plucked' from the bedrock as the glacier refreezes and moves on.

Water is also involved in freeze-thaw weathering, where water freezes and expands in cracks, weakening and breaking away the rock, making it more easily eroded by glacial or fluvioglacial processes.

- **2** AO1 = 4
 - In cold environments where the temperature fluctuates around the freezing point, freeze-thaw weathering will occur (1). Freeze-thaw weathering occurs as a result of the expansion of water as it freezes and contraction as it thaws (1).
 - Liquid water in cracks in the rock freezes as temperatures dip below 0°C at night, expanding by 9 per cent of its volume. This puts pressure on the crack in the rock (1). Over time, the repeated diurnal cycle of freezing and thawing weakens the rock (1).
- **3** AO1 = 4
 - Glacial troughs are formed when a glacier modifies a pre-existing river valley (1).
 - A glacier is in contact with the majority of the cross-section of a valley, as a result of which abrasion and plucking combine to remove large areas of the original V-shaped valley (1).
 - Erosion is assisted by freeze-thaw weathering of the valley sides (1).
 - Faults may also contribute to the steep sides of glacial troughs (1).
- **4** AO1 = 4
 - The glacial budget is the balance between inputs and outputs of a glacier (1).
 - Inputs include snow; outputs include meltwater (1).
 - In winter (and in periods of climate cooling), accumulation exceeds ablation, this means mass balance is positive, and the glacier gains mass (1).
 - In summer (and in periods of climate warming), ablation exceeds accumulation, mass balance is negative, and the glacier loses mass (1).



5 AO1 = 4

- Periglacial processes: permafrost, active layer and mass movement (1).
- Weathering processes: frost action and nivation (1).
- Mass movement processes: solifluction and frost creep (1).

The following could also be mentioned and credited, up to a total of 4 marks.

- Sources of energy water, insolation (causing changes in temperature and freeze-thaw), runoff (1).
- Geology influence of rock type, differential erosion, tectonics (1).
- Time including influence of (different) past climates (1).

Points relating to a combination of factors also to be credited.

- 6 AO1 = 4
 - Positive feedback amplifies or reinforces changes within a system (1).
 - Ice and snow have a high albedo; warmer temperatures cause melting, exposed surfaces lower albedo (1).
 - Lower albedo means more absorption of sun's radiation, causing more warming and more melting (1).
 - The impact of warming temperatures on cold environments therefore includes the formation of a positive feedback loop which intensifies warming and melting (1).

Questions 7–20 are level-marked.

AO3 – Analysis of the data evidence of relative mass change for reference glaciers (1950–2022) to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.
		 Clear connection(s) between different aspects of the evidence.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- The data shows a cumulative loss of mass for all the reference glaciers in the study.
- The period of continued cumulative loss of mass dates from around 1976.
- There is variation in the extent and rate of loss in glacial mass. This varies from a cumulative loss of around 12 per cent for the glaciers in Arctic Canada North and 39 per cent for reference glaciers in Western Canada and USA and Central Europe.
- The mean loss in mass between 1976 and 2022 is 25 per cent, but the rate of loss has increased over time: between 1976 and 1996 the loss was approximately 8 per cent; between 1996 and 2016 the loss was almost double that, at around 14 per cent.
- Some reference glaciers show more variation in their cumulative mass change than others. For example, Central Europe's reference glaciers have a smooth curve and steep decline in mass, while the reference glaciers of the Southern Andes have periods of relative accumulation as well as loss.



- Latitude is likely to explain some of the variation in decline, with the reference glaciers of Central Europe and of the USA and Western Canada having greater and more rapid cumulative loss than those at higher latitudes such as Arctic Canada North.
- The period and rate of decline can be compared with the rise in global temperatures caused by the increased emissions of carbon dioxide and other greenhouse gases from the second half of the previous century.

Example answer: Reference glaciers in Alaska, Central Europe, the Andes and Scandinavia showed brief gains in mass compared to the 1976 base point, but there is a general overall loss of mass of all reference glaciers, with some variation in the extent and rate of loss in glacial mass. This varies from a cumulative loss of around 12 per cent for the glaciers in Arctic Canada North and 39 per cent for reference glaciers in Western Canada and USA and Central Europe. The mean loss in mass between 1976 and 2022 is 25 per cent, with the rate of loss increasing over time – between 1976 and 1996 this was approximately 8 per cent; between 1996 and 2016 the loss was around 14 per cent.

Some reference glaciers show more variation in their cumulative mass change than others: e.g. Central Europe's reference glaciers have a smooth curve and steep decline in mass. The reference glaciers of the Southern Andes have periods of relative accumulation as well as loss. Latitude is likely to explain some of the variation in decline, with the reference glaciers of Central Europe and of the USA and Western Canada having greater and more rapid cumulative loss than those at higher latitudes such as Arctic Canada North. The period and rate of decline can be compared with the rise in global temperatures caused by the increased emissions of carbon dioxide and other greenhouse gases from the second half of the previous century.

8 AO3 – Analysis of the data evidence from the Dôme du Goûter glacier in the French Alps to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. Clear connection(s) between different aspects of the evidence
		• Clear connection(s) between different aspects of the evidence.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- Temperature decreases with depth in the Dôme du Goûter glacier: in 1950 the temperature at -20 m (-9.8°C) was approximately 1.3°C warmer than at the bedrock (-11.1°C) (approximately 128 m below the glacier's surface), while in 2010 the difference was approximately 2.5°C warmer (-8.4°C at 20 m, -10.9°C at 128 m).
- The same figures show that temperatures at 20 m below the surface warmed by 1.4°C between 1950 and 2010 (from -9.8 to -8.4°C); temperatures at bedrock have shown less change: 0.2°C warmer in 2010.
- The measurements show a slight increase in temperature from around 100 m below surface to bedrock: this is due to the PMP: pressure melting point of ice.
- The graph shows a change in the temperature profile of the glacier over time between 20 m and 60 m below the glacier's surface. In 1950 the temperature dropped rapidly between -20 and -40 m but then stayed relatively the same, at around -11.2°C, until bedrock. But in 2010 the top layers of the glacier showed a profile of warming between -20 and -30 m, followed by a gradual cooling.



- All the records since 1950 show that the glacier, at this point in measurement, is ablating rather than accumulating since all measures are on the warmer side of the steady state line: the point at which the glacier is neither accumulating nor ablating.
- 9 AO3 Analysis of the data evidence taken from a 400 m transect in Alaska showing the depth of active layer to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.
		• Clear connection(s) between different aspects of the evidence.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- The active layer varied in depth from between approximately 40 cm near the end of the transect to just over 2 m.
- In almost all cases, 2021 showed the greatest depth of the active layer, with the exception of a section around 170–190 m and 300 m across the transect, in which 2019 had a deeper active layer than 2021. This is useful in suggesting a trend: that the depth of the active layer has been increasing each year, with the exception of 2016 which may perhaps have been a cooler spring and summer in this part of Alaska than the other years where measurements took place.
- In almost all cases, 2016 had the shallowest active layer/deepest permafrost. The exception is a small section around 95 m across the transect.
- The deepest active layer in all years was associated with the two trails that crossed the transect at approximately 70 m and 145 m, and the stream with thermokarst around 345 m across the transect. These were the points where the active layer was deeper than 2 m. This is useful in suggesting a correlation between trails (lack of vegetation) and deeper active layers: suggesting that vegetation cover protects permafrost from thawing, since the points at which the active (thawed) layer was deepest were all where vegetation cover was absent, either due to human activity or surface drainage.
- Deeper active layer measurements were not only associated with identified trails or thermokarst features: pockets of deeper active layer occurred at around 110 m and after 350 m across the transect. This is useful as it could suggest further areas for research.
- **10** AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of glaciated and periglacial landscapes.

AO2 - Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of this landscape.AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	• 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
1	1–3	 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.

- Geomorphological processes weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional, and basal sliding; erosion: plucking, abrasion; transportation and deposition.
- Erosional and depositional landforms: corries, arêtes, glacial troughs, hanging valleys, truncated spurs, roches moutonnées. Characteristic glaciated landscapes.
- The relationship between process, time, landforms, and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes.

AO2

- AO2 marks will come from recognising the importance of freeze-thaw weathering as a dominant process in glaciated and periglacial landscapes.
- Answers should relate this to the large number of angular rock fragments in the foreground of the photograph, which have not been removed by erosion, suggesting a dominant role for weathering in this landscape. There is clearly also a ready supply of liquid water in this environment.
- Answers should explain how the cycle of freezing (in which water expands) and thawing related to fluctuating temperatures above and below 0°C in this landscape will, over time, shatter the rocks on the valley sides of the landscape, with mass movement then seeing some roll down the slope to the valley floor.
- The snow patches in the photo will also mean that nivation may contribute to the supply of frost-shattered rock: a focus of freeze-thaw and also chemical weathering (carbonation).
- Some answers may note the distinctive U-shape of the valley in the photo's background and conclude that erosion may have been involved in the landscape's formation in the past. Abrasion and plucking from a glacier look likely to have occurred here, perhaps in the formation of a corrie (the background appears to show a corrie 'lip'). In this case, some of the irregular stones in the foreground may have been deposited here when the corrie glacier melted.
- Overall, therefore, it is likely to be a landscape in which weathering now dominates, but which in the past was primarily formed by a combination of weathering and the powerful erosion of a glacier.
- 11 AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of glaciated and periglacial landscapes.

AO2 - Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of this landscape.AO1 = 2 AO2 = 4



- Geomorphological processes weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional, and basal sliding; erosion: plucking, abrasion; transportation and deposition.
- Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes.
- The relationship between process, time, landforms, and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes.

AO2

- Responses should note that the image shows a drumlin, and discuss the importance of both glacial deposition and fluvioglacial processes in the formation of this landform and landscape.
- The landform is elongated with a tapering end nearest the camera and a steeper 'stoss' end pointing away from the camera. The rest of the landscape, as far as can be seen, is flat.
- Judging from other features in the landscape, this is a large feature: perhaps 10 m high and 100 m long.
- The feature is a relict feature: it is vegetated, and the surrounding landscape shows no sign of recent glaciation.
- Responses may note that the exact process for the formation of drumlins is disputed, but that formation may have been formed when till lodged against an obstruction (deposition) and then formed into a drumlin as the ice moved over it.
- Another theory is that meltwater may create hollows in the base of the glacier which then mould subglacial till into drumlins.
- A further theory is that overloaded glaciers deposit their debris when they exit an upland area, and then shape the debris as they move over it.
- In all of the hypotheses, deposition is a key feature, but erosion is also significant in moulding the deposited till into the distinctive drumlin shape.
- 12 AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of glaciated and periglacial landscapes.

AO2 – Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of this landscape.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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
1	1–3	 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.



- Geomorphological processes weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional, and basal sliding; erosion: plucking, abrasion; transportation and deposition.
- 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

- Responses should note that the image shows a pingo and discuss the importance of both glacial deposition and fluvioglacial processes in the formation of this landform and landscape.
- Ice is significant in the formation of the pingo: in winter, groundwater in active layer sediments, often ones surrounded by permafrost, forms an ice lens, with more water freezing to the lens due to hydrostatic pressure. As the lens grows, the sediments above it bulge upwards.
- Closed-system pingos are thought to form in areas of continuous permafrost where a lake has dried up, but a pocket of underlying sediment is saturated with water.
- Open-system pingos occur where permafrost is discontinuous and water filters down into the ground. The top layer of the groundwater, near the surface, freezes in winter. The landscape in the photo suggests an open-system pingo because of the extent of surface water.
- Ice is also important in the development of the rest of the landscape: the landscape shows signs of poor drainage, which suggests an underlying layer of permafrost which keeps the active layer saturated, giving rise to numerous lakes and pools.
- **13** AO1 Knowledge and understanding of geomorphological processes. Knowledge and understanding of origin and development of glaciated and periglacial landscapes.

AO2 – Application of knowledge to show understanding of the relative importance of factors that have contributed to the development of this landscape.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.



- Geomorphological processes weathering: frost action, nivation; ice movement: internal deformation, rotational, compressional, extensional, and basal sliding; erosion: plucking, abrasion; transportation and deposition.
- Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes. The relationship between process, time, landforms, and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes.

AO2

- Answers should note that the image shows an area of bedrock, with striations evident, with a lateral moraine in the middle of the photo, and an arête in the background.
- These features suggest a landscape of both glacial erosion and deposition.
- Arêtes are formed when two neighbouring corries cut back into a mountain, with abrasion and plucking predominating. More resistant rocks may also be a factor, resisting the weathering processes that would otherwise reduce the height and steepness of the arête.
- Lateral moraines are ridges of glacial till and rock debris along valley sides. The ridges appear almost symmetrical and can be tens of metres high. Lateral moraines are largely formed by the build-up of screen slopes as a result of frost-shattering.
- Glacial striations are formed by coarse debris at the base of the glacier scratching the bedrock, so the foreground of the photo suggests glacial erosion predominated.
- Time is also a significant factor: the lateral moraine in the photo has very steep sides, a sharp crest and is unvegetated this suggests that it has recently been formed rather than being a relict feature.
- **14** AO1 Knowledge and understanding of the impacts of climate change and challenges and opportunities for human occupation and development.

AO2 – Application of knowledge and understanding to assess the extent to which opportunities for human occupation and development outweigh challenges in cold environments in coming decades. AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.



3	11–15	 AO2 – 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. AO1 – 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
2	6–10	 AO2 – 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. AO1 – 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.
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0	0	 Nothing worthy of credit.

• Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change. Management of cold environments at present and in alternative possible futures.



• Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and evaluate human responses of resilience, mitigation, and adaptation.

AO2

- Responses may consider impacts and opportunities according to environmental, economic, social, and political perspectives.
- Political opportunities resulting from climate change in cold environments include the opening up of new territories and resources which could bring significant benefits to nations' economies and security.
- These are linked to economic opportunities: melting ice opens new areas for exploitation, e.g. fossil fuel extraction, new routes for transportation across areas not previously open to shipping due to ice, new areas open for agriculture that were previously too cold for crops.
- Social opportunities could include migration of more people into previously under-populated or isolated settlements, and new opportunities for people in cold environments.
- Against these opportunities, answers should consider the negative impacts offsetting these opportunities. Politically, conflicting claims over the opening up of new territories can lead to disputes and conflicts between countries; economic impacts include infrastructure costs because of thawing permafrost; socially settlements in cold environments may be impacted by rising sea levels or by water shortages as glacial meltwater diminishes.
- The most significant challenges are likely to be environmental: sea level rise, lower water security and loss of biodiversity in fragile cold environment ecosystems.
- An assessment should then be made of the extent to which the opportunities outweigh the challenges.

Example answer: Global warming due to climate change can offer some opportunities to cold environments. New territories and resources could be opened up which could bring significant benefits to a nation's economy and security. Linked to this are the economic opportunities that melting ice could bring by opening up new areas for exploitation, e.g. fossil fuel extraction, new routes for transportation across areas previously closed to shipping due to ice. Agricultural opportunities may be presented by areas which were previously too cold for crops to grow being newly viable as productive agricultural land. Social opportunities could include migration of people into previously under-populated or isolated settlements, and new opportunities for people in cold environments.

There are, however, negative impacts of these opportunities which present challenges to human occupation and development. There may be conflicting political claims over any new territories that are opened up for exploitation, leading to disputes and conflicts between countries. The economic opportunities could be offset by the cost of installing infrastructure in a still demanding environment because of thawing permafrost. Socially, new settlements in cold environments may be impacted by rising sea levels or by water shortages as glacial meltwater diminishes and demand increases.

As is to be expected, the most significant impacts are likely to be environmental: sea level rise, lower water security and loss of biodiversity in fragile cold environment ecosystems. Any exploitation is likely to adversely affect the environmental impacts.

In light of this, an assessment should be made of the extent to which the opportunities in cold environments outweigh the negative impacts.

15 AO1 – Knowledge and understanding of the origin and development of glaciated landscapes, knowledge and understanding of fluvioglacial landforms of erosion and deposition: meltwater channels, kames, eskers, outwash plains. Characteristic fluvioglacial landscapes.



AO2 – Application of knowledge and understanding to assess the importance of fluvioglacial processes in the formation of a glaciated landscape at a local scale.

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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
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		 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.
0	0	Nothing worthy of credit.

- Origin and development of glaciated landscapes.
- Erosional and depositional landforms: corries, arêtes, glacial troughs, hanging valleys, truncated spurs, roches moutonnées. Characteristic glaciated landscapes.
- Origin and development of landforms and landscapes of glacial deposition: drumlins, erratics, moraines, till plains. Characteristic glaciated landscapes.
- Fluvioglacial landforms of erosion and deposition: meltwater channels, kames, eskers, outwash plains. Characteristic fluvioglacial landscapes.
- Case study(ies) of glaciated environment(s) at a local scale to illustrate and analyse fundamental glacial processes, their landscape outcomes and engage with field data.

AO2

- Responses will vary depending on local scale case study or case studies.
- Some case studies (e.g. Helvellyn) will be landscapes of glacial erosion in which features such as corries, aretes, glacial troughs, etc. dominate.
- Landforms associated with fluvioglacial processes may have been present at some stages of a case study landscape's development, but perhaps removed by subsequent glacial advance or by land use, especially farming.
- Some case study areas may feature landforms pointing to a limited influence for fluvioglacial processes, such as drumlin fields. Answers could develop this point with consideration of theories about the role of meltwater in drumlin formation.
- Some case study areas may have been more significantly impacted by fluvioglacial processes, for example meltwater channels, or in some cases these processes could be of great importance in creating dominant landscape features such as eskers, or the majority of the landscape in the case of outwash plains.
- **16** AO1 Knowledge and understanding of the impacts of climate change and challenges and opportunities for human occupation and development.

AO2 – Application of knowledge and understanding to assess responses to the impacts of climate change in cold environments.



Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
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- Concept of environmental fragility. Human impacts on fragile cold environments over time and at a variety of scales. Recent and prospective impact of climate change. Management of cold environments at present and in alternative possible futures.
- Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and to evaluate human responses of resilience, mitigation and adaptation.

AO2

- Answers are likely to evaluate the statement by comparing and evaluating adaptation strategies with resilience and mitigation strategies. Although the question does not ask for it specifically, case study examples could be used effectively here.
- Adaptation strategies try to help communities adapt to the new conditions brought about by climate change. Examples could include diversification: European ski resorts facing shorter seasons and thinner snow cover are diversifying into warmer-climate tourist activities such as mountain hiking. Water management is another example: as glaciers retreat in the Andes, villages that rely on glacial meltwater are constructing reservoirs and developing water conservation measures.
- Resilience strategies aim to strengthen the capacity of ecosystems and communities to withstand climate change and recover from it. Examples could include Greenland's network of monitoring stations and satellites that track changes in the ice sheet's mass and movement to help scientists to predict sea-level rise and plan for potential future scenarios.
- Mitigation strategies focus on reducing the underlying causes of climate change and the severity of its impacts. Global agreements on emissions are an example: the Paris Agreement (2015) commits countries to reduce carbon emissions with the aim of limiting global temperature increases to 1.5°C by the end of the century.
- Deciding which is the best response to the impacts of climate change in cold environments could be tackled in different ways. One could be by considering the impacts at different scales, local to global, and deciding on the value of different responses to each. For example, at the global scale the mitigation response of global agreements to limit emissions would be of significantly more value than adaptation strategies, which are not in themselves likely to help anyone outside specific communities cope with the impacts of climate change. However, at the local scale, adaptation responses will be of critical importance in enabling local communities to survive.
- **17** AO1 Knowledge and understanding of the impacts of climate change and challenges and opportunities for human occupation and development.

AO2 – Application of knowledge and understanding to assess how feedback mechanisms can help in the management of a cold environment.

AO1 = 10 AO2 = 10



Level	Marks	Description
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- Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and evaluate human responses of resilience, mitigation, and adaptation.

AO2

- Answers should refer to a case study of a glaciated landscape from beyond the UK: challenges and opportunities for human occupation and development.
- Feedback mechanisms in cold environments include the positive feedback mechanism of ice and snow having a high albedo, which is reduced when warmer temperatures cause melting that exposes surfaces with a lower albedo: a lower albedo means more absorption of sun's radiation, causing more warming and therefore more melting.
- In the Alps, precipitation is increasing, but more is falling as rain. Snow cover is expected to reduce by 25 per cent over the next 20–30 years. The reduction in snowfall affects water supply and opportunities for HEP generation. Increased rainfall contributes to landslides and avalanches. Permafrost, which holds rocky terrain together, is disappearing on south-facing rock faces on lower mountain ranges, significantly increasing landslide and avalanche risks. Reduction in snowfall at lower latitudes means that Alpine skiing resorts face a difficult future. These are all examples of the management challenges facing the Alpine glaciated environment.
- Some adaptation strategies to manage these changes do rely on an understanding of feedback mechanisms. For example, glacier blankets involve covering glaciers with reflective sheets, increasing the albedo and reducing the rate of glacial melting by 60 per cent. Afforestation strategies boost negative feedback mechanisms in which more trees increase the amount of carbon dioxide absorbed from the atmosphere, reducing warming.
- However, many of the management strategies used to manage Alpine environments are not based on an understanding of feedback systems. For example, resilience strategies are strengthening infrastructure so it can cope with the increased risk of landslide and floods as a result of climate warming. Alpine farms are diversifying, e.g. introducing vineyards and hiring out fields for camping.
- Answers are likely to conclude therefore that while feedback mechanisms are important for understanding and predicting the risks, many people in the Alpine cold environment are concerned more with adaptation strategies that allow them to cope with the impacts of climate warming.
- **18** AO1 Knowledge and understanding of the relationship between process, time, landforms and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes.

AO2 – Application of knowledge and understanding to assess the extent to which glaciated landscapes are products of past processes more so than periglacial landscapes.



AO1 = 10 AO2 = 10

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- The relationship between process, time, landforms and landscapes in glaciated settings: characteristic glaciated and periglacial landscapes.
- Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction, lobes, terracettes, thermokarst. Characteristic periglacial landscapes.
- Origin and development of glaciated landscapes.

AO2

- Answers are likely to distinguish between active and relict landscapes.
- In terms of relict glaciated landscapes, past processes will be considered key for current landscape features answers may refer to misfit streams, for example current fluvial processes are a mismatch for the erosive power of glaciation.
- Glaciated landscapes in the UK are a record of past climatic conditions: the Ice Age. In the UK, the conditions for glaciation to occur are no longer in existence, and this is increasingly the case in other countries and regions as the climate changes.
- Periglacial landscapes are more active than glaciated landscapes, and landscapes with patterned ground, solifluction lobes and pingos indicate on-going processes. When climate conditions change, these landforms change too. As a result, a 'classic' periglacial landscape today is likely to be where periglacial processes are operating.
- Landscapes that are actively glaciated today may also be considered to be products of past processes more than currently operating ones where glaciers are retreating back up glacial troughs created by glacial advances under past climate conditions.
- Answers are likely, therefore, to agree with the statement to a significant extent.
- **19** AO1 Knowledge and understanding of human impacts on fragile cold environments. Knowledge and understanding of challenges and opportunities for human occupation and development.

AO2 – Application of knowledge and understanding to assess the impact of human activity upon the natural systems and physical landscape.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
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			REVISE
		 AO1 – Very limited awar 	eness of scale and temporal change which is rarely
		integrated where appro	priate. There may be a number of inaccuracies.
0	0	 Nothing worthy of credit 	

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- Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it
 presents challenges and opportunities for human occupation and development and to evaluate human
 responses of resilience, mitigation, and adaptation.

AO2

- Answers should consider the impacts of human activity in cold environments on ecosystems, populations, and climate systems, e.g. ecosystem damage and degradation, pollution, loss of biodiversity, spread of disease, impacts on animal migrations, thawing of permafrost, sea level rise, climate change.
- Answers should consider the impacts of human activity on the physical landscape, e.g. glacial retreat, landslides, avalanches, reduction in depth and extent of permafrost, increased development of thermokarst features. Impacts can also include the increased vulnerability of degraded landscapes to extreme weather events such as heatwaves, droughts, and floods.
- The impact of human activities in these changes should be related to specific landscapes, e.g. the Alps, where climate warming is happening at around twice the global rate, leading to the loss of 30 per cent of the surface area and half of the volume of Alpine glaciers since 1850. This is having severe impacts on natural systems; e.g. Alpine plant species are migrating upwards at up to 4 m per decade. Up to 60 per cent of species may become extinct when their habitat niches disappear completely. And as temperatures increase, pathogens from the south are spreading to plant and animal species, which have no resistance to these diseases.
- The impact of human activity could also be in terms of human responses to the damage done by climate change: human responses of mitigation, resilience, and adaptation. Answers could use case study information here to describe the impacts of schemes to, for example, introduce policies such as the Alpine Convention (1995) for the sustainable development of the Alps, which includes policies for clean energy, sustainable transportation and the protection of landscapes and conservation.

20 AO1 – Knowledge and understanding of human impacts on fragile cold environments. Knowledge and understanding of challenges and opportunities for human occupation and development.
 AO2 – Application of knowledge and understanding to assess the effectiveness of sustainable management strategies in conserving periglacial environments.
 AO1 = 10 AO2 = 10

Level	Marks	Description	
4	16–20	 AO2 – Detailed evaluative conclusion that is rational and firmly based on 	
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			OXFORD REVISE
0	0	Nothing worthy of credit.	

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- Case study of a contrasting glaciated landscape from beyond the UK to illustrate and analyse how it presents challenges and opportunities for human occupation and development and to evaluate human responses of resilience, mitigation, and adaptation.
- Periglacial landforms: patterned ground, ice wedges, pingos, blockfields, solifluction, lobes, terracettes, thermokarst. Characteristic periglacial landscapes.

AO2

- Answers should consider the processes threatening periglacial environments: climate change, which is bringing warmer temperatures to periglacial environments, ozone layer thinning (most concentrated at the poles) and damage to fragile periglacial ecosystems from human activities, e.g. pollution such as oil spills.
- Answers are likely to focus on the threat to periglacial environments from global warming, which disproportionately affects cold environments. Because periglacial environments are characterised by the freezing and thawing of water, increased temperatures fundamentally change the environment, principally by extending the depth of the active layer.
- The challenge of reducing greenhouse gas emissions is a significant one at the global scale, and periglacial environments are in the front line of climate change because of their sensitivity to warming temperatures.
- However, answers should also consider the additional challenge posed in periglacial environments: the feedback systems that are beginning to add huge volumes of greenhouse gases, principally methane (a very potent greenhouse gas), to the atmosphere as permafrost melts and thawing organic matter decomposes on a vast scale.
- Answers should consider a number of sustainable management strategies relevant to combating the
 processes threatening periglacial environments, including resilience, mitigation and adaptation strategies.
 For example, the strategy of reserves and conservation areas could be evaluated as a method of
 protecting fragile periglacial areas from pollution, disturbance, and degradation.
- Monitoring of changes in periglacial environments would be relevant as a strategy for assessing the need for action to reduce damage. Environmental regulations that limit harmful developments and impose sustainable management are similarly relevant, e.g. the Alpine Convention (1995), an international treaty for the sustainable development of the Alps.
- Answers are likely to conclude that the scale of the threat to periglacial environments is such that the
 statement is fundamentally true no amount of sustainable management can halt the processes that are
 warming periglacial landscapes worldwide, at least not in the short term or even medium term. The global
 response has been too limited and contested for warming rates to be kept within safe limits for cold
 environments.
- However, answers may conclude that sustainable management strategies have a key role to play in reducing the scale of the damage and softening the impact of its changes in periglacial environments through adaptation, resilience and mitigation.
- The other threats to periglacial environments from development and pollution should also not be ignored; it is in these areas that perhaps sustainable management techniques have much to offer.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 5

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–6 are point-marked. Allow 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Largest tephra falls near the crater (1).
 - Smallest ash particles can travel for thousands of miles (1).
 - Can be a primary hazard, e.g. breathed in (1).
 - Can be a secondary hazard, e.g. when heavy rainfall destabilises tephra deposits to cause a mudflow (lahar) (1).

Example answer: Tephra is sold material ejected into the air as a result of a volcanic eruption. The largest tephra falls nearest the crater, while the smallest ash particles can travel in the atmosphere for thousands of miles. These fine tephra particles can be a primary hazard when breathed in. Tephra can also form a secondary hazard when heavy rainfalls destabilise tephra deposits to cause a mudflow (lahar).

2 AO1 = 4

- The Park model plots four stages of human responses to hazards over time (1).
- The four stages are pre-disaster, hazard event, relief, rehabilitation and reconstruction (1); a fifth stage of reflection is sometimes added to the model (1).
- The curve usually indicates quality of life, and the model illustrates the speed at which the area or country returns to normality (1).
- The steepness of the curve illustrates a) the scale of the disaster and b) the speed of response (1).
- **3** AO1 = 4
 - Mitigation is a response to hazards and involves taking action now to reduce the impact of future hazards (1).
 - In the hazard management cycle, mitigation is the stage after the response to a hazard and the recovery (1); the steps taken in mitigation then influence work on preparedness for the next disaster (1).
 - An example of mitigation for earthquake hazards would be the construction of earthquake-resistant buildings (1), which would reduce the impact of future earthquakes for a population (1).
 - Mitigation is a long-term response (1).

4 AO1 = 4

- People do not always have an accurate perception of the risk of hazards (1).
- Risk perception is influenced by experience (1), which can be misleading if, for example, hazards in a location only occur infrequently (1) once per generation or less frequently, for example (1).
- Hazard perception can be influenced by education (1); educating people about hazard risk can improve the accuracy of risk perception (1).
- In some cultures, hazards are perceived as something humans can do nothing to avoid or prevent (1), e.g. seeing earthquakes as God's will or destiny (1).



5 AO1 = 4

- Processes leading to tectonic plate movement are not fully understood and are debated (1).
- Convection currents occur in magma as hotter magma rises and cooler magma sinks. These currents may drag tectonic plates with them (1).
- Gravitational sliding may be important: slab pull is when the weight of a plate sinking into the mantle pulls the rest of the plate behind it (1).
- Ridge push is another form of gravitational sliding: when mid-ocean ridges are high, magma rises up through them, cools and becomes more dense, sliding down the ridge and moving away from it (1).

6 AO1 = 4

- Volcanic activity is common at constructive margins and some destructive margins (1).
- As plates pull apart at constructive margins, magma rises to fill the gap, causing volcanoes to form (1).
- Basaltic (basic) lava eruptions are associated with constructive margins (1).
- At destructive plate margins, the Benioff Zone of melting produces less dense magma that rises through cracks and faults to form volcanoes (1).
- When no subduction occurs, e.g. at continental–continental convergence destructive plate margins, and conservative plate margins, no melting of rock takes place, so volcanoes are not formed (1).

Questions 7–16 are level-marked.

7 AO1 – Knowledge and understanding of conditions favouring wildfires, causes of wildfires, risk management of wildfire hazards.

AO2 – Application of knowledge to the novel situation; specifically in terms of understanding of factors involved in assessing wildfire risk.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 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.
1	1–3	 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.



Nature of wildfires. Conditions favouring intense wildfires: 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.

AO2

- Answers should show understanding of causes of wildfires, e.g. by humans, either accidentally through cigarettes, sparks, disposable barbecues, etc., or on purpose (arson), or as a natural process (lightning, volcanic activity).
- In terms of causes, Figure 1 is very useful in categorising ignition risk for different areas: the high hazard areas are high risk in terms of being wildland areas with proximity to development or natural sources of ignition from lava or lightning.
- The rating of risk in terms of past history of wildfires is useful as conditions that increase ignition risk can change from year to year, e.g. clearing dry undergrowth reduces ignition risk. For people making choices about places to live, therefore, Figure 1 presents very useful information.
- There are factors affecting fire risk that are not included in Figure 1, reducing its usefulness: e.g. climate and recent weather, topography (steep slopes) and fuel supply. Other sources of information would be more useful for gaining a more detailed and potentially more current assessment of risk.
- Some users might need a more detailed and local source of information, which would make Figure 1 less useful.
- Most of the land area covered by Figure 1 is not categorised for ignition risk, possibly because Figure 1 only assesses risk for residential areas. This could reduce its usefulness for people seeking information on fire risk when hiking or travelling, for example.

Example answer: The cause of a wildfire can be human (either accidentally through cigarettes, sparks, disposable barbecues, etc., or through arson) or as a natural process (lightning, volcanic activity). Figure 1 categorises ignition risk for different areas: the high hazard areas are high risk in terms of being wildland areas with proximity to development or natural sources of ignition from lava or lightning. The rating of risk in terms of past history is useful as conditions that increase ignition risk can change from year to year, e.g. clearing dry undergrowth reduces ignition risk. For people making choices about places to live, therefore, Figure 1 presents very useful information.

However, there are factors affecting fire risk that are not included, reducing its usefulness, such as climate and recent weather, topography (steep slopes) and fuel supply. The map is relatively small scale with no background detail. A larger scale map may give an indication of whether, for example, the wildfires follow any transport or natural corridors such as roads, railways, valleys. Most of the land area covered by Figure 1 is not categorised for ignition risk, possibly because Figure 1 only assesses risk for residential areas. This could reduce its usefulness for people seeking information on fire risk when hiking or travelling, for example.

AO3 – Analysis of the data of the number of worldwide deaths from earthquakes 1818–2017 to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6



Level	Marks	Description	
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support. 	
		 Clear connection(s) between different aspects of the evidence. 	
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.	
		 Basic connection(s) between different aspects of the evidence. 	

- The graph shows an increasing trend in global deaths from earthquakes, with the highest death count before 1850 being approximately 25,000 people compared to approximately 320,000 in the first decade of the twenty-first century.
- In terms of the frequency of years with large numbers of deaths, an increasing trend is also evident, though less marked. For years with over 50,000 deaths, the first half of the nineteenth century has none, the second half shows only one (late 1860s), the periods 1900–1950 and 1951–2010 have seven each.
- There are also clusters of years with high death tolls from earthquakes: around 1908, in the 1970s and in the 2000s.
- Throughout the time period, the graph shows periods of years in which few or no deaths from earthquakes are recorded. In total, out of the 200-year period 1818–2017, deaths from earthquakes are recorded for 112 years (56 per cent).
- The increased trend in global deaths from earthquakes is more likely to be because of increasing human population than an increased incidence of earthquakes, particularly an increased number of humans living in areas at risk of earthquake. There may also have been more deaths from earthquakes in previous centuries that were not recorded, and records in the past may have been less accurate.
- 9 AO3 Analysis of the data evidence of recorded deaths and economic losses to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	Clear analysis of the quantitative evidence provided, which makes appropriate
		use of evidence in support.
		 Clear connection(s) between different aspects of the evidence.
1	1–3	Basic analysis of the quantitative evidence provided, which makes limited use of
		evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- The graph of reported deaths due to natural disasters shows a downwards trend, with variations, from 556,175 in the 1970s to 184,436 in the 2010s. Conversely, the graph of reported economic loss from natural disasters shows a clear increasing trend over the same period: from \$183.9 billion in the 1970s to \$1476.2 billion in the 2010s.
- The period 1980–1989 is an anomaly in the graph of reported deaths, with approximately 550,000 deaths due to drought. This is five times as many as in the 1970s, and in the 1990s to 2010s, deaths from drought are much lower: perhaps under 10,000 people in the 1990s and 2000s.
- Interestingly, economic losses from drought remain relatively low throughout the period. In fact, the 1980s losses from drought are less than in the 2000s, where perhaps only 5000 people died of drought.
- Storms were the biggest killer worldwide in the 1970s, 1990s and the 2000s, making up over half of all deaths from natural disasters in those decades.



- In terms of economic losses from storms, there is a clear trend of increasing losses, from around \$90 billion in the 1970s to around \$900 billion in the 2010s.
- The highest economic loss from storms came in the 2010s, when the number of deaths from storms was the lowest on record for the period around 20,000 people. Economic losses go up in wealthy areas, so this suggests that storms are impacting on more developed areas than in the 1970s, where perhaps measures are in place to reduce loss of life, e.g. evacuation measures.
- While extreme temperatures are not yet showing as a cause of heavy economic losses, they are showing an increase this century in the numbers of people killed by them. This is likely to be connected to the increase in extreme weather events because of climate change.

Level Marks Description 3 7-9 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. 2 4–6 ٠ AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence. 1 1–3 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, • interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and • relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

A01

- 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.

- Figure 4 shows that measuring radiative power is a good indication of an eruption the readings from January to May show high levels of thermal energy while there are just a few, low measurements after the eruption on 3 June. So, increases in thermal energy from a volcano are a strong predictor of an eruption.
- The increase in thermal energy will be related to magma rising in the volcano. Expansion of the magma chamber can also be monitored by measuring ground deformation using tiltmeters and GPS.

 ¹⁰ AO1 – Knowledge and understanding of impact and management issues associated with volcanoes.
 AO2 – Application of knowledge and understanding to the novel situation, to assess the scale of challenge associated with predicting volcanic eruptions.
 AO1 = 4 AO2 = 5



- However, the graph shows high levels of thermal energy throughout January to May. February shows a spike higher than the ones recorded just before the eruption, and there are similar clusters of readings in February, late March and May.
- Accurate prediction is therefore a challenge. An evacuation for a long period of time would be very disruptive to people's lives.
- Other issues not evident from Figure 4 add to the challenges of predicting volcanic eruptions, such as the nature of the eruption, its extent, and the areas likely to be at highest and lowest risk. Other measurements assist with predictions, such as gas emission monitoring and records of past eruptions, which adds to the challenge. Again, such measurements are indicative only, i.e. they indicate possible outcomes of the additional challenge of what the risks will be and what areas will be affected.

Example answer: Figure 4 shows that increased readings of radiative power (levels of thermal energy) from a volcano is a strong predictor of an eruption because the readings from January to May show high measurements which drop off completely after the eruption (3 June), with only a few low measurements. This increase in thermal energy will be related to magma rising in the volcano – pre-eruption process. Tiltmeters and GPS can also be used to measure ground deformation caused by expansion of the magma chamber.

However, Figure 4 also shows that there is no certainty in predicting eruptions. The graph shows very high levels of thermal energy from January to May. February shows the highest spike in readings including those before and during the eruption, and there are clusters of readings in February, late March, and May, which may have given the false indication that an eruption is extremely imminent.

The challenge of accurate prediction is not just in identifying whether an eruption will happen, but when it will happen. An evacuation from January to June would be very disruptive to people's lives and possibly lead to social unrest and economic instability.

Other issues not evident from Figure 4 add to the challenges of prediction, such as the nature of the eruption, its extent, and the areas likely to be at highest and lowest risk. Other measurements, such as gas emission monitoring and records of past eruptions, can help with prediction but they only indicate possible outcomes. Together with the challenge of knowing when a volcano will erupt is therefore added the challenge of what the risks will be and what areas will be affected.

AO1 – Knowledge and understanding of impact and management issues associated with seismic hazards.
 AO2 – Application of knowledge and understanding to the novel situation, to assess the scale of challenge associated with managing earthquake hazards, specifically tsunami.
 AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.



OXFORD

A01

- The nature of seismicity and its relation to plate tectonics: forms of seismic hazard: earthquakes, shockwaves, tsunamis, liquefaction, landslides. Spatial distribution, randomness, magnitude, frequency, regularity, predictability of hazard events.
- Impacts: primary/secondary; environmental, social, economic, political. Short- and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation.

- Figure 5b shows that Okitsu's location increases the risk of tsunami not only is the settlement coastal but it is sited within a bay that narrows as it reaches Okitsu. A tsunami caused by an earthquake offshore would then experience a funnelling effect as it moved towards the coast, amplifying the height of the tsunami as it reached Okitsu.
- A narrow inlet to the east of Okitsu would increase this risk further: Figure 5a shows how high land either side of the inlet would intensify this funnelling effect. Having water inundating Okitsu from both the south and east would also add to the management challenge. Topography in this case is an important challenge for managing tsunami risk in this location.
- Figure 5b also indicates that there is only one road out of/into Okitsu which could hamper rescue operations and short-term responses for the settlement in the event of a tsunami. For example, landslides caused by earthquake or debris from a tsunami could easily block this road, given the mountainous terrain that it winds through. Making sure that short-term responses are effective would be a major challenge for managing tsunami risk in Okitsu.
- Figure 5a shows that the majority of Okitsu would be inundated with flooding of over 10 m. Tsunamis in Japan have reached heights of 25 m. A key challenge would be providing quick access to shelters at a high enough altitude to escape inundation.
- Evacuation centres located on the hillsides overlooking Okitsu are numbered 1–6. Shelters 1 and 2 have an altitude of over 30 m, making them safe locations from even the most extreme tsunami. They also have the largest capacity. However, they are out of town and not all residents might be able to reach them quickly enough, especially as a third of residents are over the age of 75.
- Towers 7, 8 and 10 in the town centre are 15 m above sea level. This height is presumably built to deal with all but the most extreme tsunami, perhaps without being visually overwhelming. Their central location means many residents would be able to reach them quickly, if there was little time to react. An effective tsunami warning system would be needed as part of managing earthquake risk to give people time to reach the hillside shelters.



12 AO1 – Knowledge and understanding of impact and management issues associated with storm hazards.
 AO2 – Application of knowledge and understanding assessing usefulness of prediction in the management of storm hazards.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

A01

- The nature of tropical storms and their underlying causes. Forms of storm hazard: high winds, storm surges, coastal flooding, river flooding and landslides. Spatial distribution, magnitude, frequency, regularity, predictability of hazard events.
- Impacts: primary/secondary, environmental, social, economic, political. Short- and long-term responses: risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention, and adaptation.

- Prediction involves forecasting when and where a hazard will occur using science, e.g. using data from early warning systems and weather monitoring satellites. Putting this data together with historical data allows computer modelling to predict the likely track of the storm and its severity.
- Predictions can provide the necessary lead time to evacuate populations at risk, potentially saving lives. This is crucial in densely populated coastal areas.
- Predictions can also trigger emergency services to prepare and respond more effectively, reroute flights and shipping away from danger areas and ensure that critical infrastructure services (power, water) are protected or backed up.
- Preparedness as well as prediction is critical in the management of storm hazards. For example, people need to have places to evacuate to, safe routes to travel to reach them, and to know about/have practised this evacuation in advance for it to be effective.
- The speed and effectiveness of emergency responses to storm hazards that have not been predicted accurately will depend on preparedness, which, together with mitigation measures to deal with expected



and unexpected impacts from a hazard, will enable communities to manage the risk from storm hazards even if prediction turns out to be inaccurate.

13 AO1 – Knowledge and understanding of impact and management issues associated with wildfire hazards.
 AO2 – Application of knowledge and understanding assessing threats to the successful management of wildfire hazards.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

A01

- Nature of wildfires. Conditions favouring intense wildfires: 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.
- 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.

- Most wildfires occur during or after prolonged dry periods when vegetation (the fuel for wildfires) has become dry and combustible.
- Although other conditions also favour wildfires (e.g. vegetation supply, topography, fuel supply, wind direction and human activity), this key criterion of dry weather means that where climate change increases the duration and severity of droughts, then climate change will be a substantial threat to the successful management of wildfires.
- The successful management of wildfire events relies on weather monitoring, fuel monitoring, satellite surveillance (for hot spots at increased risk of wildfire), mitigation (clearing dead vegetation, controlled burning) and prevention (e.g. laws restricting campfires or barbeques). These measures are all effective



and their effectiveness is not challenged by climate change itself, however what climate change does is increase the scale of the challenge and its cost – monitoring, mitigation and prevention need to be over much larger areas and over much longer time periods.

- Mitigation may be where opportunities exist to counter the increased risks of wildfires as a result of climate change-induced droughts since removing the fuel for wildfires through controlled burning outside the wildfire season would significantly reduce risks.
- Similar wildfire events can have very different outcomes depending on where they are in the world, which suggests that other factors may also be important in successful management of wildfire events, in particular the cost of preparedness and mitigation measures. As a result, low levels of investment, government corruption or ineffective communication may also be considered as significant threats to successful management globally, alongside climate change.
- 14 AO1 Knowledge and understanding of impact and management issues associated with hazards.
 AO2 Application of knowledge and understanding assessing usefulness of prediction in the management of hazards.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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.
		 AO1 – 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.
1	1–5	 AO2 – 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.
		 AO1 – 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.
0	0	 Nothing worthy of credit.
1	1	

- Spatial distribution, randomness, 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.
- Case study of a multi-hazardous environment beyond the UK to illustrate and analyse the nature of the hazards and the social, economic, and environmental risks presented, and how human qualities and responses such as resilience, adaptation, mitigation and management contribute to its continuing human occupation.

- Prediction involves forecasting when and where a hazard will occur using science, e.g. using data from seismographs (to detect earthquakes), tiltmeters and GPS (to measure ground deformation), meteorological data that is used in computer modelling (to predict landfall of storm events, storm surge heights, etc).
- Prediction can provide the necessary lead time to evacuate populations at risk, potentially saving lives.
- Prediction can also trigger emergency services to prepare and respond more effectively.
- Predictions are not static: each disaster or occurrence of a natural hazard provides information that is used in future predictions or to improve modelling of hazard risks.
- Prediction is imperfect. For example, we can predict where seismic hazards are likely to occur (along plate margins), but not when, exactly where, or at what magnitude they will occur. Volcanic eruptions are a little easier to predict signs can be monitored that show an eruption is imminent, but when, and at what magnitude, is not currently predictable.



- An example is the Eyjafjallajökull eruption, Iceland April 2010 eruption was preceded by a series of earthquakes and small fissure eruptions, but the ash cloud produced, and the 39-day duration of the eruption were both unpredicted, causing disruption to flights across Europe, and economic loss.
- Managing the response to natural hazards is crucial: effective, efficient evacuation to safe places; preparedness of the emergency responses for swift and effective response.
- Mitigation measures to deal with expected and unexpected impacts from a hazard will enable communities to manage the risk from hazards even if prediction turns out to be inaccurate.
- Examples could be given in which the response to hazards was inadequate. For example, 6190 people died in Typhoon Haiyan (8 November 2013) despite predictions giving 48 hours warning of the tropical storm and 800,000 people being evacuated. The evacuation shelters were not all built far enough inland to save people from drowning in the 5 m storm surge. Hurricane Katrina (29 August 2009) caused the deaths of 1200 people in New Orleans, partly because the levees protecting the city were not built to deal with a Category 5 storm. Accurate prediction meant one million people had been evacuated, but 60,000 poorer residents did not evacuate, some because of lack of transport, others to stay to protect their property from looters.
- Prediction and management need to work together to feed into preparedness for the next hazard. For
 example, following the Eyjafjallajökull eruption, research has taken place into the impacts of volcanic ash
 on jet engines to establish safe thresholds for flying in the event of another ash cloud over Europe, and
 Europe's airspace is now split into nine blocks which can be closed individually rather than all having to be
 shut at once.

Example answer: Prediction involves forecasting when and where a hazard will occur using science, e.g. using seismographs (earthquakes), tiltmeters and GPS (ground deformation), meteorological data (landfall of storm events, storm surge heights). Accurate prediction can provide the time for evacuations to take place, and to prepare emergency services to be able to respond more effectively. Each natural hazard event provides information that is used in future predictions or to improve modelling of hazard risks.

Prediction is imperfect. For example, with seismic hazards, while we can predict where hazards are likely to occur (along plate margins), we cannot predict when they will occur or at what magnitude as they can happen without warning. Volcanic eruptions can be monitored for signs that show an eruption is imminent, but predicting exactly when and at what magnitude is not currently possible. Eyjafjallajökull in Iceland had been dormant for 200 years when it erupted in April 2010. The eruption was preceded by a series of earthquakes and small fissure eruptions giving some warning, and 800 people were evacuated with no loss of life. The long duration (39 days) of the eruption was not predicted, nor was the huge ash cloud, which caused the cancellation of 10,000 flights across Europe, and a \$5 billion loss to the European economy.

So, as there are many aspects of natural hazards that are not predictable, managing the response to an event is crucial – practising evacuation to safe places via safe routes. The preparedness of emergency services affects the speed and effectiveness of their response, and this, together with mitigation measures to deal with expected and unexpected impacts from a hazard, will enable communities to manage the risk from hazards even if prediction turns out to be inaccurate.

There are many examples in which the response to hazards was inadequate. For example, Typhoon Haiyan killed 6190 people in 2013 despite predictions giving 48 hours warning of the tropical storm and 800,000 people being evacuated. One reason was that evacuation shelters were not built far enough inland to save people from drowning in the 5 m storm surge. Similarly, 1200 people died in 2005 in New Orleans as a result of the Category 5 Hurricane Katrina, because levees protecting the city had been built to deal with a Category 3 storm. Accurate prediction meant one million people were evacuated, but 60,000 poorer residents were not, either because of lack of transport, or to stay to protect their property from looters.



In conclusion, prediction and management need to work together to feed into effective preparedness for the next hazard. For example, following the Eyjafjallajökull eruption, research has taken place into the impacts of volcanic ash on jet engines to establish safe thresholds for flying in the event of another ash cloud over Europe, and Europe's airspace is now split into nine blocks which can be closed individually rather than all having to be shut at once.

15 AO1 – Knowledge and understanding of plate tectonic theory and how it relates to seismic hazards, knowledge and understanding of responses to seismic hazards.

AO2 – Application of knowledge and understanding to assess the extent to which plate tectonic theory has influenced human responses to seismic hazards.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
		integrated where appropriate. There may be a few inaccuracies.
1	1-5	 AO2 – 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 to the application of knowledge and understanding in different contexts.
		 AO1 – 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.
0	0	Nothing worthy of credit.

- 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.
- The nature of seismicity and its relation to plate tectonics: forms of seismic hazard: earthquakes, shockwaves, tsunamis, liquefaction, landslides. Spatial distribution, randomness, magnitude, frequency, regularity, predictability of hazard events.
- Impacts: primary/secondary; environmental, social, economic, political. Short- and long-term responses; risk management designed to reduce the impacts of the hazard through preparedness, mitigation, prevention and adaptation.
- Impacts and human responses as evidenced by a recent seismic event.
- Hazard perception and its economic and cultural determinants. Characteristic human responses fatalism, prediction, adjustment/adaptation, mitigation, management, risk sharing – and their relationship to hazard incidence, intensity, magnitude, distribution and level of development.

- Plate tectonic theory is that the lithosphere is broken up into tectonic plates that move over the semi-fluid asthenosphere beneath them.
- The relationship between plate tectonic theory and seismic hazards is the recognition that the spatial distribution of earthquakes maps to the margins of most of the tectonic plates.
- Different kinds of plate margins have been observed to produce different kinds of earthquakes.
- As a result of the theory and research to back it up, we can predict where seismic hazards are likely to occur along plate margins. However, people have long known which areas were prone to earthquakes, so this is not a new influence.
- Plate tectonic theory has meant changes in monitoring and prediction, e.g. measurement of the amount of stress that has built up along a fault/plate margin is valuable in the human responses of preparing for and mitigating against seismic hazards.



- Plate tectonic theory has also influenced the perception of seismic hazards, and therefore human responses to them. For example, in the past more areas may have had a fatalistic perception of earthquakes.
- The confirmation through experimentation of plate tectonics as a scientific explanation for seismic hazards allows for different perceptions that make predictions, management, and mitigation of seismic easier to achieve.
- The evolution of improved monitoring, preparedness, response, recovery and mitigation measures has been a bigger influence. As a result of improvements in these areas, death tolls for major earthquakes are often much smaller than they would have been in past centuries, despite more people living in the affected areas.
- For example, the development of earthquake resistant buildings with seismic isolators that separate the building from the ground with a layer of springs or rubber and automatic window shutters that prevent broken glass from falling into the streets below.
- A likely conclusion therefore is that plate tectonic theory has been more important for understanding seismic hazards than for responding to them.
- 16 AO1 Knowledge and understanding of case study of a local scale of a specified place in a hazardous setting.
 AO2 Application of knowledge and understanding to assess the community's responses to the risks in relation to the physical nature of the hazard.
 AO1 = 10 AO2 = 10

Level Marks Description 16-20 4 • AO2 – 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 ٠ application of knowledge and understanding in different contexts. AO1 – 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. 3 11-15 AO2 – 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 ٠ application of knowledge and understanding. AO2 – Generally clear evidence of links between knowledge and understanding ٠ to the application of knowledge and understanding in different contexts. AO1 – 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.



2	6–10	• AO2 – 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.
		 AO1 – 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.
1	1–5	 AO2 – 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.
		 AO1 – Very limited relevant knowledge and understanding of place(s) and environments
		 A01 Isolated knowledge and understanding of key concents, processes and
		• AO1 - isolated knowledge and understanding of key concepts, processes and interactions and change. There may be a number of inaccuracies
		interactions and change. There may be a number of inaccuracies.
		AU1 – Very limited awareness of scale and temporal change which is rarely
		integrated where appropriate. There may be a number of inaccuracies.
0	0	 Nothing worthy of credit.

• Case study at a local scale of a specified place in a hazardous setting to illustrate the physical nature of the hazard and analyse how the economic, social, and political character of its community reflects the presence and impacts of the hazard and the community's response to the risk.

AO2

- Answers should relate to a local-scale case study of a hazardous setting, for example Lahaina, Hawaii. A brief summary of the physical nature of the hazard, e.g. wildfires.
- Consideration of impacts to a hazard event, for example August 2023 wildfires in the case of Lahaina.
- Answers could relate responses to theories about hazard perception and characteristic responses, and the Park model.
- Consideration of responses to the hazard, and evaluation of their effectiveness. In the case of Lahaina, systems and logistics were both seen to be less responsive than they should have been: poor communication, misunderstandings in the community about the severity of the hazard risk (hazard perception), lack of water for firefighting and issues with the emergency management system in general.
- Consideration of community responses after the hazard event: in the case of Lahaina, the process of clearing away toxic debris took several months, and rebuilding has been delayed by slow processes for attaining building permits in Hawaii.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 6

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–6 are point-marked. 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - A plagioclimax is a sub-climax ecosystem area where the arresting factor is human interference (1).
 - Part of the concept of succession in which ecosystems increase in complexity, diversity, and stability over time (1).
 - A climatic climax is the final stage of succession in which flora and fauna have reached a state of dynamic equilibrium (1).
 - A plagioclimax occurs where an ecosystem has not been able to reach the climatic climax (1).
 - An example of a plagioclimax is heather moorland, where the arresting factor is yearly burning (1).

Example answer: A plagioclimax is a sub-climax ecosystem area where the arresting factor is human interference. It is part of the concept of succession, in which ecosystems increase in complexity, diversity and stability over time. A climatic climax is the final stage of succession in which flora and fauna have reached a state of dynamic equilibrium. A plagioclimax occurs where an ecosystem has not been able to reach the climatic climax. An example of a plagioclimax is heather moorland, where the arresting factor is yearly burning.

2 AO1 = 4

- Energy flows through ecosystems in a one-way direction, passing from producers to consumers to decomposers (1).
- Trophic levels represent the different positions within a food chain or web, indicating an organism's role in energy transfer (1).
- Energy is lost as heat at each trophic level (1).
- There are typically four trophic levels in an ecosystem: producers, primary consumers, secondary consumers, and tertiary consumers (1).
- **3** AO1 = 4
 - Human activity is a factor that can influence change in ecosystems at a global scale through anthropogenic climate change (1).
 - Factor operates through human interventions in the carbon cycle, releasing carbon dioxide from the combustion of carbon stores in the lithosphere (1).
 - Carbon dioxide is a greenhouse gas, so increased emissions produce atmospheric warming which transfers warmth back to the Earth's surface (1).
 - Warming leads to climate change; ecosystems are primarily influenced by climate conditions and so climate change leads to ecosystem change (1).



- **4** AO1 = 4
 - Coral polyps have a symbiotic relationship with zooxanthellae (photosynthetic algae) allowing corals to thrive in nutrient-poor waters (1).
 - Warm waters (23–29°C) are essential for the growth and survival of the coral polyps and their symbiotic algae (1).
 - Clear and sunlit waters to support the photosynthesis of zooxanthellae, which provide the corals with essential nutrients (1) / Shallow waters, usually less than 45 m deep, as beyond that depth, insufficient light limits coral growth (1).
 - Stable salinity levels, as rapid fluctuations can stress corals and disrupt their ability to maintain proper internal conditions.

5 AO1 = 4

- Summer temperatures average 10–18°C, winter temperatures average 2–7°C but do dip below 0°C (1).
- There is between 800 mm and 1400 mm of precipitation per year on average (1); wet all year round but typically more precipitation in winter than summer (1).
- There are four distinct seasons (spring, summer, autumn, winter). As temperatures fall and daylight hours reduce in autumn, deciduous trees shed their leaves (1).
- Temperate deciduous woodland, such as ash and oak, is the climax community for the temperate climate biome (1).
- **6** AO1 = 4
 - A biome is a large-scale ecological area with plants and animals that are well-adapted to their environmental conditions (1).
 - The distribution of terrestrial biomes is largely a match to the pattern of climate zones (1), with variation due to relief, continentality and, at a local scale, geology (1).
 - Examples of biomes include the tropical rainforest biome and the savanna grassland biome (1).

Questions 7–16 are level-marked.

AO3 – Analysis of the extent of terrestrial biomes to identify patterns and anomalies in the data, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.
		 Clear connection(s) between different aspects of the evidence.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- There are areas considered to be intact wilderness on all the continents shown (Antarctica is not shown).
- The largest areas of wilderness are in high latitudes of the northern hemisphere. Here there are some large areas of wilderness showing no fragmentation, e.g. Greenland.
- At lower latitudes and in eastern Russia, intact wilderness areas are more fragmented, broken up by areas where the human footprint is <4.



- Areas of high damage include the east coast of China, India, central and western Europe and the east of the USA.
- Areas with lower damage correspond to areas where conditions are challenging for humans to live, such as the Sahara Desert in north Africa or the Himalaya mountain range.
- Areas of higher damage correspond to areas with dense human habitation and where human habitation and development has a long history.

Example answer: There are areas considered to be intact wilderness on all the continents shown (Antarctica is not shown). The largest areas of wilderness are in high latitudes of the northern hemisphere. Here there are some large areas of wilderness showing no fragmentation, e.g. Greenland. At lower latitudes and in eastern Russia, intact wilderness areas are more fragmented, broken up by areas where the human footprint is <4. Areas showing high damage include the east coast of China, India, central and western Europe and the east of the USA. Areas with lower damage correspond to areas where conditions are challenging for humans to live, such as the Sahara Desert in north Africa or the Himalaya mountain range. Areas of higher damage correspond to areas with dense human habitation and where human habitation and development has a long history.

8 AO3 – Analysis of the global extent of live hard coral from 1980 to 2020 to identify patterns and anomalies in the data, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of evidence in support.
		 Clear connection(s) between different aspects of the evidence.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of evidence in support.
		 Basic connection(s) between different aspects of the evidence.

- The mean estimated coral cover (central blue line) shows an overall declining trend over the 40-year period from approximately 33 per cent of cover to 29 per cent of cover.
- There appear to be specific periods where coral cover declines more sharply, e.g. in the late 1990s (drop of nearly 3 per cent cover) and around 2010 (drop of 2 per cent).
- There are also periods of slight recovery or plateauing, e.g. in the early 2000s, the mid-2010s, where the decline in coral cover slows down or the mean estimate increases slightly, and towards 2020 where some signs of recovery are evident.
- The improvement in confidence about survey data has significantly reduced uncertainty: it may be that the period from the late 1970s to the late 1990s showed a similar amount of variation in cover (peaks and troughs) as in the later period.
- **9** AO1 Knowledge and understanding of the savanna grassland biome and typical development issues relating to this biome.

AO2 – Application of knowledge and understanding to the novel situation, to assess development issues in the savanna grassland biome.

AO1 = 4 AO2 = 5



Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

The nature of the savanna grassland biome to include:

- main characteristics
- ecological responses to the climate, soil, and soil moisture budget adaptations by flora and fauna
- human activity and its impact on each biome, typical development issues in each biome to include changes in population.
- economic development, agricultural extension and intensification, implications for biodiversity and sustainability.

- Figure 3's degradation spiral shows how the loss of vegetation cover can lead to soil compaction, loss of nutrients, reduced infiltration, and increased soil erosion.
- This can lead to further loss of biomass and perennial grass species.
- Managing this negative feedback loop is challenging as each step of degradation exacerbates the next.
- Crop rotations that protect soils, rotational grazing and reseeding and replanting of grasses can all help to break the downwards spiral.
- In both spirals, water influences vegetation cover and biomass/productivity. In savanna grasslands with seasonal rainfall, water availability can be highly variable. Climate change also has an effect.
- Sustainable management strategies are needed to enhance water conservation and water harvesting for development.
- Managing biomass productivity involves balancing the need for grazing and the need for resting periods to allow grasslands to recover. In addition to the factors shown in Figure 3, it is important to manage fire regimes.
- Controlled burning early in the dry season regenerates grassland growth, prevents the spread of invasive species and fertilises the soil with ash. Early-season burning also reduces the risk of extensive late-season wildfires.



• Also not included in Figure 3 is the significant challenge of population growth and economic development. Sustainable policies must balance economic development with the conservation of these ecosystems.

Example answer: Figure 3's degradation spiral shows how the loss of vegetation cover can lead to compacting of soil, loss of soil nutrients, reduced water infiltration and increased soil erosion from accelerated runoff, which, in turn, can lead to further loss of biomass and perennial grass species.

Managing this negative feedback loop is a key development issue as each step of degradation exacerbates the next. Education in crop rotations that protect soils, rotational grazing and reseeding and replanting of grasses can help to break the downwards spiral.

In both spirals, water is a central factor influencing vegetation cover and biomass/productivity. In savanna grasslands, water availability can be highly variable due to seasonal rainfall – and climate change. Access to water is a key development issue. This shows the need for sustainable management strategies to enhance water conservation and water harvesting.

Managing biomass productivity is a key development issue if growing livestock populations are not to permanently degrade grassland resources. It involves balancing the need for grazing and the need for resting periods to allow grasslands to recover. It is also important to manage fire regimes (not included in Figure 3). Controlled burning early in the dry season regenerates grassland growth, prevents the spread of invasive species and fertilises the soil with ash. Early-season burning also reduces the risk of extensive late-season wildfires.

A significant challenge for economic development that is not included in Figure 3 is population growth. Sustainable policies must balance economic development with the conservation of these ecosystems.

10 AO1 – Knowledge and understanding of the tropical rainforest biome and typical development issues relating to this biome.

AO2 - Application of knowledge and understanding to assess the implications of the information in Figure 4 for tropical rainforest biomes under stress from climate change.AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.

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

The nature of the tropical rainforest biome to include:

- main characteristics
- ecological responses to the climate, soil, and soil moisture budget adaptations by flora and fauna
- human activity and its impact on each biome, typical development issues in each biome to include changes in population.
- economic development, agricultural extension and intensification, implications for biodiversity and sustainability.

AO2

- Figure 4 shows three responses to climate change temporal, spatial and body size changes in species, and their potential mismatch effects on species interactions.
- Many species have adapted to very specific conditions and are often dependent on a particular plant or food source; mismatches due to changes in phenology could lead to declines in plant reproduction and thus affect the entire food web.
- In the dense and stratified structure of tropical rainforests, a loss of specialised relationships could occur as species that are adapted to particular microhabitats shift and no longer interact with their usual partners.
- Body size changes could lead to size mismatches between species that interact, such as predators and prey or pollinators and flowers. Smaller body sizes may affect the survival and reproduction rates of species.
- Altered conditions could increase the numbers and success of invasive species, which could outcompete native species and further disrupt traditional species interactions.
- Declines in interactions like pollination can have feedback effects. For example, the loss of certain tree species due to failed pollination would have a significant knock-on effect for all the other species that depend on that particular tree species.

Changes in species interactions are likely therefore to reduce rainforest biodiversity and reduce the resilience of rainforest biomes to further stress related to climate change, e.g. droughts or wildfire.

11 AO1 – Knowledge and understanding of the main characteristics and ecological responses to the climate, soil and soil moisture budget of a lithosere.

AO2 – Application of knowledge and understanding to analyse interconnections between climate, vegetation and soils in a lithosere.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

- Concepts of succession: seral stages, climatic climax, sub-climax, and plagioclimax.
- Nature of terrestrial ecosystems and the inter-connections between climate, vegetation, soil, and topography which produce them. Ecosystem responses to changes in one or more of their components or environmental controls.
- Succession and climatic climax as illustrated by lithoseres and hydroseres.

AO2

- In the British Isles, lithoseres have been produced by glacial retreat and isostatic rebound the uplifing of an area after the weight of glaciation has been removed. Climate change therefore has a key role in the formation of conditions under which a lithosere can begin to develop.
- Pioneer species are the first organisms that colonise the bare rock (typically mosses/lichens). They will be hardy (e.g. xerophytes) and autotrophic (do not need external nutrients except sunlight)
- Mosses/lichens, along with natural weathering, begin to break the rock down, creating soil and increased water retention. Climate conditions of freeze-thaw assist the weathering process.
- Decomposers break down dead mosses and lichens, releasing nutrients into the soil. These require periods of warmer temperatures and moisture to operate.
- As the soil develops, conditions then become favourable for grasses and ferns to colonise the area, outcompeting the mosses and lichens. In turn, flowering plants and shrubs colonise the area climate conditions are not responsible for this change but instead the increasing depth and nutrient supply of the soil.
- 12 AO1 Knowledge and understanding of the main characteristics of the tropical rainforest biome and typical development issues in the biome.

AO2 - Application of knowledge and understanding to assess the role global governance has to play in securing a viable future for the tropical rainforest biome.AO1 = 4 AO2 = 5

Level	Marks	Description	
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

- The nature of the tropical rainforest biome to include:
 - o main characteristics
 - o 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, has implications for biodiversity and sustainability.
- Case study of a specified region experiencing ecological change to illustrate and analyse the nature of the change and the reasons for it, how the economic, social, and political character of its community reflects its ecological setting and how the community is responding to change.
- The emergence and developing role of norms, laws, and institutions in regulating and reproducing global systems.
- Issues associated with attempts at global governance, including how interactions between the local, regional, national, international, and global scales are fundamental to understanding global governance.

- This question is synoptic: global systems and global governance. Case study information could be effectively used in answers to this question.
- Global governance mechanisms, such as the United Nations Framework Convention on Climate Change (UNFCCC), which includes the REDD+ mechanism (Reducing Emissions from Deforestation and Forest Degradation), provide frameworks for conservation efforts. They encourage countries to collaborate on reducing deforestation and forest degradation.
- Through global governance, financial mechanisms can be established to support conservation efforts: this funding can help spread the benefits of sustainable forest management to local communities who otherwise benefit more from deforestation.
- Global governance bodies can aid in the development of international policies and treaties, such as the Paris Agreement on climate change (2015) and offer platforms for sharing best practices (as REDD Plus does for sustainable forest management).



- The regulation of international trade in endangered species through agreements like CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is another example of the power of global governance.
- However, global governance has limitations and those often relate to national interests and the lack of enforcement mechanisms. Where national interests or national politics do not align with the aims of global governance then its role will be limited (e.g. deforestation in the Brazilian Amazon increased markedly under the presidency of Jair Bolsonaro).
- National interests will include the opportunities for development of forest areas: while global governance can provide mechanisms and models for spreading the benefits of sustainable forest management and conservation, these benefits can only go so far when compared with the demand for farmland from a growing population, for example.
- Key to a successful partnership of global and national governance therefore could be the identification of reasonable targets for maintaining forest areas (such as Malaysia's 50 per cent forest cover target), mechanisms for monitoring threats to these targets and the development of benefits for as wide a range of stakeholders in forest areas as possible.
- 13 AO1 Knowledge and understanding of a distinctive local ecosystem including adaptations by flora and fauna, knowledge and understanding of challenges and opportunities presented by sustainable development of a local scale ecosystem.

AO2 - Application of knowledge and understanding to evaluate the extent to which causes of declining biodiversity have been successfully managed in a local-scale ecosystem.AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – 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.
0	0	 Nothing worthy of credit.

- The main characteristics of a distinctive local ecosystem (such as an area of heathland, managed parkland, pond, dune system). Ecological responses to the climate, soil and soil moisture budget adaptations by flora and fauna.
- Case study of a specified ecosystem at a local scale to illustrate and analyse the nature and properties of the ecosystem, human impact upon it and the challenges and opportunities presented in its sustainable development.

- Answers should relate to a case study of a specified ecosystem at a local scale: for this answer the case study is the Sefton Coast ecosystem.
- By including all major landowners and stakeholders, the Sefton Coast Landscape Partnership (SCLP) ensures that conservation measures are implemented across the ecosystem, leading to more comprehensive management of biodiversity threats.



- The active management of dune habitats, including the restoration of dune slack habitats and the removal of invasive species, is vital for the maintenance and recovery of native biodiversity, including rare species like the sand lizard and northern dune tiger beetle.
- The strategy to direct visitors away from sensitive areas and towards less vulnerable areas by upgrading walkways and providing information boards helps minimise human impact on key habitats.
- The involvement of volunteers in conservation efforts not only increases manpower for projects like habitat restoration but also raises local awareness and stewardship of the natural environment.
- Despite 75 per cent of the area being greenbelt, past development has fragmented the sand dune ecosystem. Ongoing demands for housing and other development continue to pose a threat to the integrity of the ecosystem.
- Coastal erosion and changes in deposition patterns present ongoing challenges that require adaptive management strategies. Global climate change is a persistent threat that can exacerbate these issues.
- The high demand for leisure activities like golf, which has led to many golf courses on the Sefton Coast, can conflict with conservation objectives, particularly if these activities lead to further habitat loss or degradation.
- The decline in grazing land has led to dunes becoming overgrown with vegetation, altering the habitat structure and potentially affecting the species that depend on open sandy areas.
- There is always a question of the long-term sustainability of such conservation efforts. They often require continuous funding, political will, and community support, which can fluctuate with economic and social priorities.

Example answer: The Sefton Coast is a stretch of coastline of Merseyside, in the north-west of the UK. Close to the densely populated area of Merseyside, it is popular with visitors, creating challenges to conserve the local ecosystem while promoting the area socially and economically. To accomplish this, the Sefton Coast Landscape Partnership (SCLP) was created. It includes all major landowners and stakeholders and aims to direct visitors away from the most sensitive parts of the ecosystem towards less sensitive areas by upgrading walkways and providing information boards to educate visitors to minimise human impact on key habitats. The involvement of volunteers in conservation efforts not only increases manpower for projects like habitat restoration but also raises local awareness and stewardship of the natural environment.

The designation of parts of the Sefton Coast as sites of special scientific interest (SSSI) offers a high level of protection, where it is an offence to damage natural features. This legal backing is crucial for the conservation of habitats and species. The active management of dune habitats, including the restoration of dune slack habitats and the removal of invasive species, is vital for the maintenance and recovery of native biodiversity, including rare species like the sand lizard and northern dune tiger beetle.

Despite 75 per cent of the area being greenbelt, past development has fragmented the sand dune ecosystem. Ongoing demands for housing and other development continue to pose a threat to the integrity of the ecosystem. The decline in grazing land has led to dunes becoming overgrown with vegetation, changing the habitat structure, and potentially affecting the species that depend on open sandy areas.

Coastal erosion and changes in deposition patterns present ongoing challenges that require adaptive management strategies. Global climate change is a persistent threat that can exacerbate these issues. The high demand for leisure activities, which has led to many golf courses being created on the Sefton Coast, can conflict with conservation objectives, particularly if these activities lead to further habitat loss or degradation.

There is always a question of the long-term sustainability of such conservation efforts. They often require continuous funding, political will, and community support, which can fluctuate with economic and social priorities.


14 AO1 – Knowledge and understanding of the savanna grassland biome including adaptations by flora and fauna, knowledge and understanding of challenges and opportunities presented by sustainable development of a local scale ecosystem.

AO2 – Application of knowledge and understanding to evaluate the extent to which threats to biodiversity have been successfully managed in the savanna grassland biome.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16-20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.



The nature of savanna grassland 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 each biome
- typical development issues in each biome to include changes in population, economic development, agricultural extension and intensification, implications for biodiversity and sustainability.

- Mineral nutrient cycling is an important factor in the natural development of all ecosystems. It is the slow mineral nutrient cycling of cold climates, for example, or dry climates, that determines the vegetation types that have evolved to characterise those ecosystems.
- As with all ecosystems, however, the speed of mineral nutrient cycling is dependent on other factors temperature and precipitation being key. The availability of mineral nutrients also depends on other factors, for example underlying bedrock, the extent of leaching (linked to precipitation).
- In the case of savanna grasslands, it is precipitation that determines this ecosystem, since in the most part any increase in precipitation results in the growth of trees, since trees outcompete grasses once established as their canopies mean insufficient light reaches grasses for them to photosynthesise: regardless of mineral nutrient cycling.
- Fire is a factor in the development of savanna grassland. The adaptations to fire of savanna vegetation are evidence of the pivotal importance of fire in the development of savanna grassland: e.g. grasses have deep root systems resilient to fire; many trees and plants have adapted to be fire-resistant, some needing fire for reproduction. Fire speeds up the mineral nutrient cycle by releasing nutrients from burned vegetation into the soil.
- It is also fire that sometimes prevents grassland from being forested in areas where precipitation is high enough for tree development, but it is low precipitation in the dry season that is the principal factor for savanna grassland development, and the effect of fire in clearing non-resistant species from the grasslands is not linked to mineral nutrient cycling.
- Soil can be a factor: most savanna grasslands have quick-draining sandy soils or laterite soils. These can be nutrient-poor due to leaching.



- Human impacts also important: humans have been influencing grassland savanna landscapes in Africa for 300,000 years, especially through fires. Climate change increases the duration/severity of droughts fragmenting savanna grasslands.
- **15** AO1 Knowledge and understanding of a specified region experiencing ecological change and how the community is responding to change.

AO2 – Application of knowledge and understanding to assess the sustainability of a community's response to ecological change in its region.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1-5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – 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.
0	0	Nothing worthy of credit.

• Case study of a specified region experiencing ecological change to illustrate and analyse the nature of the change and the reasons for it, how the economic, social and political character of its community reflects its ecological setting and how the community is responding to change.

- Answers should relate to a case study of a specified region experiencing ecological change: for this answer the case study is deforestation in Malaysia.
- In the period 2000–2012, Malaysia had the highest rate of deforestation in the world. The rate has since reduced, from 244,300 hectares of primary forest lost in 2012 to 73,000 in 2020.
- This suggests some success in Malaysia's response to the extreme ecological changes resulting from deforestation.
- Malaysia has used initiatives such as licensed selective logging, replanting programmes, the establishment
 of national parks, nature reserves, the promotion of ecotourism, national plans and targets and
 membership of global schemes such as REDD Plus. Each of these responses has its own set of successes
 and challenges.
- The introduction of licensed selective logging has helped in minimising the impact of logging by ensuring only certain trees are removed. Together with replanting, this response has enabled Malaysia to work towards national targets of 50 per cent forest cover nationally.
- However, secondary succession in replanted or selectively logged areas often leads to a subclimax community, which may not fully replicate the biodiversity and complexity of the original rainforest. Additionally, the effectiveness of prosecution against illegal loggers varies, impacting on forest conservation efforts and reducing sustainability.
- National parks have been established with a focus on threatened ecosystems, helping to preserve biodiversity and serve as a refuge for endangered species.
- However, the creation and management of these conservation areas require continuous funding and monitoring. Conservation efforts have to be balanced with the rights and needs of local communities.



- Ecotourism in protected areas like the Sungai Yu Forest Reserve provides a sustainable income source that supports conservation efforts. It also raises awareness among visitors about the importance of rainforest conservation.
- Managing ecotourism to prevent negative impacts on the environment and local communities is essential. This limits the numbers of tourists and therefore the potential economic benefits for local communities.
- 16 AO1 Knowledge and understanding of a distinctive local ecosystem including adaptations by flora and fauna, knowledge and understanding of concepts of succession: seral stages, climatic climax, sub-climax, and plagioclimax.

AO2 – Application of knowledge and understanding to assess the extent to which the properties of a specified ecosystem at a local scale reflect the climatic climax community.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – 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.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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.



		 AO1 – 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.
1	1–5	• AO2 – 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.
		 AO1 – 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.
0	0	Nothing worthy of credit.

- Concepts of succession: seral stages, climatic climax, sub-climax, and plagioclimax.
- The main characteristics of a distinctive local ecosystem (such as an area of heathland, managed parkland, pond, dune system). Ecological responses to the climate, soil and soil moisture budget adaptations by flora and fauna.
- Case study of a specified ecosystem at a local scale to illustrate and analyse the nature and properties of the ecosystem, human impact upon it and the challenges and opportunities presented in its sustainable development.

AO2

- Answers should relate to a case study of a specified ecosystem at a local scale.
- Assessment of what the climatic climax community is for the specified ecosystem: for example, a psammosere, where bare sand is colonised by plants.
- If conservation efforts are rewilding or restoring the natural pioneer species or later seral stages for degraded parts of the local scale ecosystem, the extent to which this should still be considered an arresting factor (human interference) or the resumption of natural progression towards the climatic climax community.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 7

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–8 are point-marked. 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Global marketing includes advertising, marketing, and promotion beyond the domestic market (1), reaching a variety of consumers in different regions and countries (1).
 - Provides access to new markets (1).
 - Standardised advertising, marketing and promotion applied globally but can be adapted for local markets to reach diverse consumers/audiences (1).
 - Increased cultural sensitivity of major brands so advert content is not misinterpreted or inappropriate for different audiences (1).
 - Use of social media to promote product (1).
 - Use of internet technology to sell products via Amazon etc (1).
 - Global brand recognition and image (1).

Example answer: Global marketing includes advertising, marketing, and promotion beyond the domestic market so that companies reach a variety of consumers in different regions and countries, including in new markets.

Standardised advertising, marketing and promotion can be applied globally but it can be adapted for local markets to reach diverse consumers. There is an increased cultural sensitivity of major brands so marketing content is not misinterpreted or inappropriate for different audiences. The use of social media is an important way to promote products globally, and internet technology is used to sell products, e.g. via Amazon. Global brand recognition and image is an important part of globalisation.

2 AO1 = 4

- Some states (HDEs and some EMEs) are economically dominant by having higher GDP, GDP per capita PPP, and being the home of TNCs (1).
- This economic dominance allows some states to control global flows of resources and trade, and to access the global market (1).
- Some countries have a history of economic influence, such as former colonial powers (1).
- Some states are politically dominant by influencing trade rules, having decision-making powers in financial intergovernmental organisations and by having permanent seats on the UN Security Council (1).
- Some states influence other global groups, e.g. trade blocs (1).
- Some states are technologically dominant through IT, pharmaceutical research and development, and intellectual property. They increase their income by developing high-value goods and services (1).
- Some states have more money to access or import resources (1).
- Some states can influence cultures around the world through language, media and brands which promote their own culture, values and behaviour (1).



3 AO1 = 4

- Foreign direct investment is a key aspect of globalisation (1).
- Investment can be money from individuals, governments and TNCs invested in other countries (HDEs, EMEs and LDEs) (1).
- Volume of global FDI has increased since the Second World War (1).
- Pattern of investment has changed over time (1).
- After the Second World War, HDEs typically invested in HICs. Post 1980s, the increase in free trade and the desire of TNCs to reduce costs and increase profits has seen more investment by HDEs in EMEs and LDEs (although USA, China and Brazil were top 3 recipients of FDI in 2022) and by EMEs, e.g. China invests in LDEs (1).
- Rise in ethical investments which are more environmentally or socially responsible (1).

4 AO1 = 4

Using Coca Cola as an example of a TNC.

- Coca Cola makes concentrates and syrups and sells this to authorised bottling partners (1).
- Bottling partners mix concentrates with still/sparkling water, and sweeteners if required, and prepare, package, sell and distribute the finished drinks (1).
- Coca Cola also has 'finished product' operations where the company owns or controls bottling, sales and distribution (1).
- In 2006 the bottling plants owned by Coca Cola joined together to form Bottling Investments Groups (BIG) (1).
- Bottling plants are near to markets as transport costs increase once water is added to the concentrate (1).
- Coca Cola has bought existing bottling plants rather than building new ones to rapidly expand into new markets (1).
- Coca Cola has bottling plants in Europe, Middle East & North Africa, Latin America, North America and Asia Pacific (1).

5 AO1 = 4

- Norms are the shared expectations and standards of behaviour within a society (1).
- Laws are formal rules set by governments and governing bodies (1).
- Both act as ways of influencing human activities, economic interactions, and environmental practices on a global scale (1).
- Norms shape attitudes towards how different groups interact with each other. Companies' activities may be influenced by attitudes towards business practices and social responsibility (1).
- Norms affect people's attitudes towards managing resources, tackling environmental challenges, or promoting conservation (1).
- International laws including treaties and conventions regulate global issues such as human rights, climate change and biodiversity and influence how countries act on these issues (1).
- Global rules on trade are set by the WTO and influence how countries trade and how trade conflicts are resolved (1).
- Laws provide a framework that encourages stability of global systems (1).
- **6** AO1 = 4
 - The global commons are parts of the planet that fall outside national jurisdictions and to which all nations have access (1).
 - Antarctica is considered to be a global common, recognised under international law, along with the high seas, the atmosphere and Outer Space (1).



- Antarctica is a large, remote continent in the Southern hemisphere with a unique environment (1).
- It is managed to ensure peace, enable scientific research, and promote environmental protection, important principles for the sustainability of the global commons (1).
- While countries have laid claim to sectors of Antarctica, no country has sovereign rights on the continent (1).

7 AO1 = 4

- Globalisation leads to an increased demand for resources, causing land degradation, deforestation, and loss of biodiversity (1).
- Globalisation leads to an increase in transport and travel, causing a rise in carbon emissions (1).
- Globalisation can be a long-term contributor to climate change (1).
- Globalisation increases manufacturing in LDEs. Air, water, land, noise, and visual pollution can arise if environmental protection/law is not enforced (1).
- Globalisation can lead to an increased risk of environmental accidents, e.g. oil spills (1).

Questions 9–22 are level-marked.

8 AO1 – Knowledge and understanding of how global systems can promote growth for places.
 AO2 – Applies knowledge and understanding to the novel situation to analyse and evaluate the role of global systems in the growth of places.
 AO1 = 2 AO2 = 4

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	emonstrates clear knowledge and understanding of concepts, processes, interactions
		nge.
		pplies knowledge and understanding to the novel situation offering clear analysis and
		on drawn appropriately from the context provided. Connections and relationships
		different aspects of study are evident with clear relevance
1	1–3	• AO1 – Demonstrates basic knowledge and understanding of concepts, processes,
		interactions, change.
		AO2 – Applies limited knowledge and understanding to the novel situation
		offering basic analysis and evaluation drawn from the context provided.
		Connections and relationships between different aspects of study are basic with
		limited relevance.

A01

- Form and nature of economic, political, social, and environmental interdependence in the contemporary world.
- Issues associated with interdependence including how unequal flows of people, money, ideas, and technology within global systems can sometimes act to promote stability, growth and development but can also cause inequalities, conflicts and injustices for people and places.

- Global systems lead to increased interconnectivity between the world's people, places and economies.
- Global systems can lead to increased growth in places. This growth can be economic, social, political, and environmental.
- Global systems can lead to increased economic development as countries' economies can evolve from primary to secondary to tertiary and quaternary. This can lead to increased wealth for different groups in



different ways, e.g. employees – wages; TNCs – profits; governments – tax revenue. Increased education can improve skills to meet demands of emerging employment sectors.

- Global systems can lead to growth and change in the built environment through business development and urban development, e.g. through rural to urban migration.
- Global systems benefit some places but can result in decline in others.
- Evaluation of how global systems such as globalisation can lead to growth, such as the type shown in Figure 1.
- Quaternary sector industries such as Infosys can lead to economic growth and the development of the built environment in EDEs.

Example answer: Figure 1 shows Infosys, an Indian technology company, showing development in the quaternary sector. The quaternary industry is knowledge intensive and creates higher value products and services. This increases GDP through higher value exports promoting economic growth. Infosys in Figure 1 can take advantage of global systems to develop new markets. Indian TNCs develop products for domestic and global markets. As a technology firm, it can increase its business based on IT developments including the internet. The rise in highly educated labour forces in EMEs such as India can also provide a skilled labour pool, including women. Providing higher income opportunities in India slows down the brain drain as Indians are able to obtain highly paid jobs without moving to other countries, e.g. the USA. Global systems can also be used to attract global talent. Figure 1 shows the Infosys HQ, with landscaped office space. This can improve the quality of the built environment but also puts pressure on natural resources, including land, when businesses expand. While global systems can promote economic growth, they can also lead to decline in some areas, e.g. through deindustrialisation of some locations in HDEs.

AO1 – Knowledge and understanding of trading relationships between LDEs and the rest of the world.
 AO2 – Applies knowledge and understanding to the novel situation to analyse and evaluate trading relationships between LDEs and other economies.
 AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.



- Global features and trends in the volume and pattern of international trade and investment associated with globalisation.
- Trading relationships and patterns between large, highly developed economies such as the United States and the European Union, emerging major economies such as China and India and smaller, less developed economies such as those in sub-Saharan Africa, southern Asia and Latin America.
- Differential access to markets associated with levels of economic development and trading agreements and its impacts on economic and societal wellbeing.

- Figures 2a, 2b and 2c show data for Central African Republic (CAR), an LDE in Central Africa, to reflect the trading relationships between LDEs and other economies.
- Figure 2a shows CAR's main trade partners which include the EU and China, which are major players in global trade.
- Figure 2b shows that CAR displays a trade deficit for both exports and imports. The value of CAR's service exports is lower than goods exports, showing the service sector is less developed than the primary/secondary sectors.
- CAR's top 5 exports in Figure 2c are mainly primary products either for direct use (e.g. wood for construction) or for processing (diamonds, gold), adding value, which are then sold at a higher price.
- CAR's top 5 imports in Figure 2c are mainly manufactured products of high value showing a dependency on imports of those products that are vital for economic and social development.
- Figure 2c shows that CAR ranks towards the bottom of world economies for both exports and imports LDEs have less access to global markets than HDEs and EMEs.
- CAR has important trade with a neighbouring country (Uganda, Figure 2a). LDEs can have important trade relationships with adjacent states as reduced transport costs can be reflected in lower product prices in some cases.
- Unlike other LDEs, CAR's top 5 imports do not include oil or other fuel sources which are important for some LDEs to provide fuel for their industries and transportation.
- 10 AO3 Analysis of the data evidence about the nature of TNCs to identify patterns, anomalies and using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	Clear analysis of the quantitative evidence provided, which makes appropriate
		use of data to support.
		 Clear connection(s) between different aspects of the data.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of
		data to support.
		 Basic connection(s) between different aspects of the data.

- Figure 3 shows the change in rank between the top 10 TNCs by revenue (\$US million) between 2003 and 2023.
- All top 10 TNCs have significantly higher revenues in 2023 than 2003, showing the increase in growth and economic power of TNCs over the last 20 years. Walmart has remained number 1 in 2023 and has



increased its revenue by almost 150 per cent, reflecting the economic power of US companies and global economic importance of the retail sector.

- In 2003, five companies were American, two were Japanese, two jointly owned by two HDEs, and one was British. However, in 2023, five companies were American and three were Chinese, showing the continued global influence of US TNCs as well as the economic rise of EMEs, such as China.
- In 2003, five were in the vehicle sector, four were in the energy sector, one was retail.
- In 2023, six were in the energy sector, two were in retail, and one was in each of technology and health. This shows the decline of global influence of vehicle companies and the rise in economic importance of technology and health-related companies. TNCs in the quaternary sector (health) can increase in economic influence.
- Energy TNCs are highly important as these are linked to global and national energy security and facilitate development through providing fuel for industry/transport and commercial/domestic electricity. Saudi Aramco's rank of 2 in 2023 indicates that fossil fuels are still important despite calls for reduced carbon emissions.
- None of the top 10 companies in either 2003 or 2023 have their base in LDEs.

11 AO1 – Knowledge and understanding of different aspects of globalisation.

AO2 – Applies knowledge and understanding to the novel situation to analyse and evaluate the different aspects of globalisation.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

AO1

• The impacts of globalisation to consider the benefits of growth, development, integration, stability against the costs in terms of inequalities, injustice, conflict, and environmental impact.

- Focus group participants identified different aspects of globalisation focusing on economic, social and political issues rather than environmental ones, which are also part of defining globalisation aspects. These are shown in Figure 4.
- Positive aspects of globalisation identified included cooperation, learning from other cultures, freer trade, online shopping, more awareness of current events and technology allowing communication between countries.



- Negative viewpoints identified included China taking advantage of us, overextending our power, loss of
 international clout, immigrants taking our jobs, diluting our culture, loss of industry and small businesses,
 inequality.
- Other points could be taken positively or negatively depending on the groups affected, so would need more clarification, e.g. automation, outsourcing and Brexit.
- Immigration and cultural exchange can lead to fears of unemployment, loss of cultural identity and increased learning from other cultures.
- Economics and trade are a key aspect which involves TNCs (or multinational organisations) and globally connected supply chains, changing importance of industries, free trade and trade agreements, threat of deindustrialisation in western economies and fears of increasing inequality.
- Community raises awareness of being a global citizen, increased connectivity and increased awareness of current events.
- Technology is important for different stakeholders, e.g. social media, and can change work production and flows through automation.
- The focus on political, economic, social and technological only no environmental points considered yet there are benefits and costs for this too, e.g. international agreements on habitat protection, managing the global commons, environmental degradation through economic development driven by globalisation.
- US/UK viewpoints only (HICs) other people/groups/nationalities including EMEs and LICs may have contrasting views.
- 12 AO1 Knowledge and understanding of how UN agencies play a role in global governance and how this raises issues

AO2 – Applies knowledge and understanding to the novel situation to assess the issues associated with the attempts at global governance by UN agencies

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

A01

- The UN was established in 1945 and its agencies are involved with key issues such as promoting international peace and security, protecting human rights, providing and managing humanitarian aid, advocating sustainable development and climate action, and setting international law.
 - UN agencies such as the UN Security Council, UN Peacekeeping, UN Development Programme, UN Framework Convention on Climate Change and UN Human Rights Council are attempts at global governance.



• Issues associated with attempts at global governance by UN agencies, including how UN agencies can work to promote growth and stability but may also exacerbate inequalities and injustices.

AO2

- Through the UNDP, the UN has focused on reducing inequalities through its programme of 17 Sustainable Development Goals (SDGs) by tackling different aspects of development (economic, social, political, and environmental) running between 2015 and 2030.
- The 17 SDGs followed on from 8 UN Millennium Development Goals (2000–2015) indicating that challenges remained after 2015.
- Whilst there have been areas of success such as a reduction in the number of people living in poverty, increased primary school attendance and lower infant mortality rates, there are uneven levels of progress across the SDGs.
- 13 AO1 Knowledge and understanding of how fishing is an important part of the Antarctic global commons.
 AO2 Applies knowledge and understanding to the novel situation to analyse and evaluate the importance of fishing as part of the Antarctic global commons.
 AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

A01

- An outline of the contemporary geography, including climate, of Antarctica (including the Southern Ocean as far north as the Antarctic Convergence) to demonstrate its role as a global common and illustrate its vulnerability to global economic pressures and environmental change.
- Threats to Antarctica arising from:
 - \circ climate change
 - \circ ~ fishing and whaling
 - $\circ \quad$ the search for mineral resources
 - tourism and scientific research.

- Antarctica is one of the global commons which are not owned by one country and where international agreements and cooperation are needed to manage the environment.
- Fish are an important part of the food chain in Antarctica and can be primary or secondary consumers.



- Fish are important to the sustainability of the global commons as they are eaten by many secondary consumers (e.g. seals) and top predators (e.g. orca). Consumers and predators rely on eating large quantities of fish to survive in the harsh Antarctic climate.
- Fish are caught in the Antarctic for human consumption, including for sale to restaurants (e.g. toothfish)
- Catch limits are set for different fish and vary for different areas of the Antarctic by CCAMLR. Licenses have to be obtained to fish in these areas.
- Overfishing can lead to a reduction in the food available for the Antarctic ecosystem species and potentially leading to collapses in populations.
- Illegal fishing can lead to exploitation of marine resources and negatively affect conservation initiatives
- Some fishing practices can damage marine habitats e.g. bottom trawling on the seabed.

Example answer: Antarctica can be threatened by fishing if it is not appropriately managed. Antarctica is one of the global commons. Its oceans, and therefore its resources, are not governed by one country but by international agreements by intergovernmental organisations. Fish are an important part of the food chain in Antarctica and can be primary or secondary consumers. Fish are important to the sustainability of the global commons as they are eaten by many secondary consumers (e.g. seals) and top predators (eg orca). Consumers and predators rely on eating large quantities of fish to survive in the harsh Antarctic climate. Fish are caught in the Antarctic for human consumption, including for sale to restaurants (e.g. toothfish)

Overfishing can lead to a reduction in the food available for the Antarctic ecosystem species and potentially leading to collapses in populations. Illegal fishing can lead to exploitation of marine resources and negatively affect conservation initiatives. Some fishing practices can damage marine habitats e.g. bottom trawling on the seabed. CCMALR is an intergovernmental organisation that regulates the conservation of Antarctic marine living resources, including fish. Catch limits are set for different fish and vary for different areas of the Antarctic by CCAMLR. Licenses must be obtained to fish in these areas. If managed effectively, threats to Antarctica arising from fishing can be reduced.

14 AO1 – Knowledge and understanding of whaling in Antarctica and its governance.

AO2 – Applies knowledge and understanding to the novel situation to analyse and evaluate the governance of whaling in Antarctica.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.



- Critical appraisal of the developing governance of Antarctica. International government organisations to
 include United Nations (UN) agencies such as United Nations Environment Programme (UNEP) and the
 International Whaling Commission. The Antarctic Treaty (1959), the Protocol on Environmental Protection
 to the Antarctic Treaty (1991); IWC Whaling Moratorium (1982) their purpose, scope and systems for
 inspection and enforcement.
- The role of NGOs in monitoring threats and enhancing protection of Antarctica.
- Analysis and assessment of the geographical consequences of global governance for citizens and places in Antarctica and elsewhere to specifically consider how global governance underlies and impacts on students' and other people's lives across the globe.

AO2

- Figure 7 shows that the governance of whaling has had an impact in the Antarctic region, including in South Georgia, with the number of Antarctic blue whales found in 2020 being 'unprecedented'.
- Stocks of krill and fish are healthy as the area remains a place for summer feeding, suggesting that the governance of whaling is in balance with other treaties, such as CCAMLR, which are linked to the marine environment.
- Figure 7 suggests that whaling protection measures have worked and that densities of humpback whale have increased, benefiting from protection from whaling.
- Whales in Antarctica were hunted commercially for oil, meat and other products, leading to a significant decline in their stocks.
- The IWC banned commercial whaling around the world from 1986 onwards leading to a rebound in stock levels of whale species in Antarctic waters. However, not all countries have signed the Whaling Moratorium, e.g. Japan, so this may have an effect on future stock levels.
- **15** AO1 Knowledge and understanding of that transportation and communication technologies are a factor in globalisation.

AO2 – Application of knowledge and understanding to analyse and evaluate the importance of transport and communication technologies in globalisation.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.



11–15	 AO2 – 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. AO1 – 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.
6–10	 AO2 – 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. AO1 – 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.
1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	Nothing worthy of credit.
	11-15 6-10 1-5

- Dimensions of globalisation: flows of capital, labour, products, services and information; global marketing; patterns of production, distribution and consumption.
- Factors in globalisation: the development of technologies, systems and relationships, including financial, transport, security, communications, management and information systems and trade agreements.



AO2

- Transport and communication technologies have been key factors in globalisation.
- Container ships allow for faster movement and higher volume of goods globally; jet aircraft allow for faster movement of people increasing labour movements and migration.
- Global supply chains for TNCs benefit from faster transport as they are more efficient (faster access to raw materials, movement to factories and distribution to global markets).
- Internet technology, including smart phones, has led to the faster exchange of services and money transfers, real time collaboration, 24/7 economy, TNC operations.
- Information is rapidly exchanged via social media, entertainment streaming over the internet spreads cultural influences more easily.
- Faster transport and more developed routes aid growth of global tourism.
- Overdependency on goods imported using global transport increases vulnerability to external shocks (COVID-19, conflicts). This may cause countries to try to regenerate domestic industries.
- There is a digital divide with some places less connected through the internet.
- There are increasing concerns about privacy, which may limit spread of information and ideas.
- Other factors are important for globalisation: trade agreements influence goods, services and intellectual property traded (type, volume, price); government policies influence economic and cultural exchange; external factors, e.g. political stability and geopolitical events.

Example answer: The development of transport and communication technologies undeniably plays a pivotal role in the process of globalisation. These advancements have significantly transformed our world by enabling the faster movement of goods, people and information across borders, often in higher volumes. However, while transport and communication technologies are crucial, it is essential to recognise that other factors also contribute significantly to globalisation.

Transport technologies, such as container ships and jet aircraft, have revolutionised the movement of goods and people globally. Container ships allow for faster and more efficient transportation of goods, contributing to the growth of global supply chains for transnational corporations (TNCs). The faster movement of people by jet aircraft has led to increased labour movements and migration, resulting in a more interconnected world.

The global supply chains for TNCs benefit immensely from faster transport. It enables quicker access to raw materials, efficient movement to factories, and swift distribution to global markets. This efficiency not only enhances economic productivity but also contributes to the interdependence of national economies within the global system.

Moreover, internet technologies, including smartphones, have played a crucial role in the globalisation process. The internet facilitates the rapid exchange of services, money transfers, real-time collaboration, and the operation of TNCs in a 24/7 economy. Social media and entertainment streaming platforms contribute to the spread of cultural influences, resulting in a more interconnected global society.

However, it is crucial to acknowledge the potential drawbacks of an overreliance on global transport and communication technologies as factors in globalisation. The COVID-19 pandemic highlighted the vulnerability of global supply chains to external shocks and conflicts, prompting concerns about the overdependency on imported goods and the need for countries to develop or redevelop domestic industries.

Additionally, there is a digital divide, with some regions less connected through the internet. This digital divide can hinder the even distribution of benefits associated with globalisation. Moreover, increasing concerns about privacy may limit the free flow of information and ideas, challenging the unrestricted exchange that is often associated with a globalised world.



While transport and communication technologies are significant, other factors are equally important for globalisation. Trade agreements influence the type, volume and price of goods, services and intellectual property that are traded globally. Government policies play a crucial role in shaping economic and cultural exchange, and external factors, such as political stability and geopolitical events, can significantly impact global dynamics.

In conclusion, while the development of transport and communication technologies is indeed a vital factor in globalisation, it is not the only one. Transport and communication can be seen as key drivers in the movement of goods, services, people and capital. The internet, including social media, contributes to our 'shrinking world' and can spread different cultures and values around the world. However, other factors such as trade agreements and government policies can influence globalisation in different ways depending on the actions and responses of different countries.

16 AO1 – Knowledge and understanding of what global systems are and how they can cause conflicts and promote development.

AO2 – Application of knowledge and understanding to analyse and evaluate the likelihood of global systems causing conflicts as opposed to promoting development.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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.
		•	AO1 – 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.
1	1–5	•	AO2 – 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.
		•	AO1 – Very limited relevant knowledge and understanding of place(s) and
			environments.
		•	AO1 – Isolated knowledge and understanding of key concepts, processes and
			interactions and change.
		•	AO1 – Very limited awareness of scale and temporal change which is rarely
		1	integrated where appropriate. There may be a number of inaccuracies.
0	0	•	Nothing worthy of credit.

AO1

- Form and nature of economic, political, social and environmental interdependence in the contemporary world.
- Issues associated with interdependence including how:
 - unequal flows of people, money, ideas and technology within global systems can sometimes act to promote stability, growth and development but can also cause inequalities, conflicts and injustices for people and places
 - unequal power relations enable some states to drive global systems to their own advantage and to directly influence geopolitical events, while others are only able to respond or resist in a more constrained way.

- Global systems link different countries, organisations, people and decision-makers around our world.
- Global systems are an essential element of economic, political, social and environmental interdependence between different groups.
- Global systems can lead to inequalities. Unequal flows of people, money, ideas and technology can cause conflict but also promote development. Unequal power relationships can also cause conflicts but also may promote development.
- Global systems may cause conflicts in different ways, e.g. competition for natural resources such as water, minerals, energy, and labour.



- Global systems can increase inequalities between and within countries, leading to tension and conflict between different groups.
- Some groups can feel marginalised and disempowered by global systems, leading to social unrest.
- Geopolitical power struggles can occur over contested spheres of influence, leading to an increase in military spending and potential armed conflict.
- Global systems can promote interdependence and interconnection and increased economic cooperation, decreasing chance of conflict.
- Trade agreements can provide security of resources.
- International organisations can focus on improving quality of life, e.g. UN SDGs, World Bank, and IMF development loans).
- Global systems can increase cultural exchange and awareness, offering more opportunities for social development.
- Global systems enhance and are enhanced by the spread of technology, e.g. internet, medical research, which brings individual benefits and improves levels of development.
- Global systems can provide job opportunities and improve social mobility.
- Global systems can bring better international cooperation at times of crisis, e.g. coordinated natural disaster relief.
- Some international issues need global systems to tackle them, e.g. the environment, political instability.
- 17 AO1 Knowledge and understanding that access to markets is unequal and this can lead to both positive and negative impacts on economic and societal wellbeing.

AO2 – Application of knowledge and understanding to analyse and evaluate the extent to which differential access to markets can bring both positive and negative impacts on economic and societal wellbeing. AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated to the application.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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.
		• AO1 – 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.
1	1–5	 AO2 – 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.
		 AO1 – Very limited relevant knowledge and understanding of place(s) and
		environments.
		 AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change.
		• AO1 – Very limited awareness of scale and temporal change which is rarely
		integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- Globalisation fosters a growing Interdependence between different regions, countries and groups across the world.
- Differential access to markets associated with levels of economic development and trading agreements and its impacts on economic and societal wellbeing.
- HDEs have promoted their own differential access to markets due to different levels of development and varying access to trade agreements.
- Global features and trends in the volume and pattern of international trade and investment associated with globalisation. These trends and patterns often favour HDEs.
- Trading relationships and patterns vary between large, highly developed economies such as the United States and the European Union, emerging major economies such as China and India, and smaller, less developed economies such as those in sub-Saharan Africa, southern Asia and Latin America.



AO2

- Gaining access to markets has generally increased for all since the Second World War, helping to increase wealth and improve employment opportunities, resulting in improved development and quality of life for many but some argue that HDEs have benefited more than some EMEs and LDEs
- Some groups, organisations and countries have more access to markets than others.
- Differential access to markets can bring positive impacts on economic and societal wellbeing but these may vary in importance, scale and timescales between different groups, and some argue that HDEs have been major beneficiaries.
- Differential access to markets can bring negative impacts on economic and societal wellbeing but these may vary in importance, scale and timescales between different groups, and some argue that HDEs have been major beneficiaries.
- Differential market access has led to female empowerment for workers as more women are employed and gain an income, leading to more financial independence.
- Access to markets is more advantageous for HDEs and EMEs than for LDEs. This has led to increased global and regional inequalities in economic growth and wealth, employment type and wages, and quality of life.
- Some countries are at a disadvantage as they have to overcome higher tariffs on goods, subsidies, quotas when exporting products.
- Some countries produce and export lower value primary products but import higher value goods and services causing trade deficits.
- HDEs and EMEs are more likely to have money to invest in education and develop knowledge-based industries, e.g. IT, pharmaceuticals, therefore increasing dependency of LDEs on them.
- Poorer working standards and conditions in some countries can lead to the 'race to the bottom'.
- Those with better access to markets may increase their economic interdependence, raising the risk of being affected by financial crises.
- FDI can help LDEs access new markets, gain access to technology and stimulate the local economy through the positive multiplier effect.

Example answer: Globalisation has led to a growing interdependence between different regions, countries and groups across the world. This increase in interconnectivity and increased reliance on other global partners has led to significant global issues. Some would argue that this is due to the fact that HDEs have promoted their own differential access to markets due to different levels of development and varying access to trade agreements. Trading relationships and patterns vary between large, highly developed economies such as the United States and the European Union, emerging major economies such as China and India, and smaller, less developed economies such as those in sub-Saharan Africa, southern Asia and Latin America. This leads to inequality, not just economically but also socially and environmentally.

HDEs are more likely to export higher value goods to EMEs and LDEs, e.g. IT products and pharmaceuticals, as well as services e.g. management consulting and finance whilst importing cheaper manufactured goods. LDEs are more likely to export raw materials and manufactured products, whilst importing more expensive goods and services. This creates a trade deficit and reduces the potential for investment in aspects of the country's economy which could encourage long term growth e.g. investment in health and education. Whilst HDEs play a significant role in the volume and value of international trade and investment, EMEs including China, are also important players e.g. investing in parts of Sub-Saharan Africa through infrastructure. This increases interdependence between EDEs and LDEs, although some would argue that the relationship is imbalanced as LDEs can become more dependent on EDEs, further exacerbating global inequalities. Therefore, it is argued that access to markets is more advantageous for HDEs and EMEs than for LDEs as it has led to increased global and regional inequalities in economic growth and wealth, employment type and wages, and quality of life.



Countries can benefit from being in a trade bloc as this increases the potential for trade and also can reduce barriers to trade within the bloc e.g. the removal of subsidies, quotas and tariffs. e.g. Mexico has benefited from its membership of USMCA (formally NAFTA) as jobs were created in its growing car manufacturing industry. However, Mexico's economic dependence on the USA caused significant issues during global recessions e.g. in 2008. However, countries that do not have access to trade blocs can be at a disadvantage. They have to negotiate their own trade agreements, which may not be as favourable as it they were within the bloc. Trade blocs can also have protectionist policies which makes it harder for countries outside to access their markets as their prices are higher due to unfavourable tariffs. Some argue that HDEs have also been the major beneficiaries of WTO policies, the IGO which governs rules on international trade. The WTO promotes free trade, and some argue that while this encourages competition, it can lead to a 'race to the bottom' in terms of price, leading to criticisms of low wages and poor working conditions for employees. However, some argue that free trade can cause cheap imports to flood into a country, negatively affecting domestic markets, leading to the closure of industries and increased unemployment.

On the other hand, LDEs may themselves benefit from HDEs own access to markets. HDEs may increase their FDI in LDEs which can open access to new markets, improve access to technology, gain knowledge of current business practices to help them compete in the global market and stimulate the local economy, increasing the multiplier effect. FDI from TNCs in LDEs has also led to an increase in female employment, e.g. in the textile industry, which allows women to earn an income and increase their financial independence. This helps to reduce gender inequality.

Overall, increasing global interdependence does lead to significant issues. Some would argue that the major role of HDEs in the global trading system continues to promote global inequalities. The free trade system promoted by the WTO encourages free trade but as the terms of trade (lower value of exports such as primary products compared to higher value of imports such a manufactured goods, technology, and services) often favours HDEs, LDEs are left at an economic disadvantage, so continuing unfair differences between countries. This can also be exacerbated by membership (or not) of trade blocs. However, it is not just HDEs which is linked to issues related to economic interdependence. China, an EDE, also can cause issues such as dependency through its investment in LDEs.

18 AO1 – Knowledge and understanding that international government organisations (IGOs) such as the UN, World Bank (WB), International Monetary Fund (IMF), World Trade Organisation (WTO) can create unequal power relations between states. Knowledge and understanding that alternative factors including other organisations (national governments, TNCs, trade blocs), location, historical factors, resource endowment, trade, vulnerability to factors such as conflict and climate change can create unequal power relations between states.

AO2 – Application of knowledge and understanding to analyse and evaluate the role of IGOs in creating unequal power relations between states. Application of knowledge and understanding to analyse and evaluate the role other factors in creating unequal power relations between states. AO1 = 10 AO2 = 10

 Level
 Marks
 Description

 4
 16–20
 • AO2 – Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question.

 • AO2 – Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout.
 • AO2 – Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts.



		• AO1 – Detailed, highly relevant and appropriate knowledge and understanding of
		place(s) and environments used throughout.
		 AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout
		processes throughout.
		• AOT – Detailed awareness of scale and temporal change which is well integrated where appropriate
3	11-15	 AO2 – 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.
		AO1 – 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.
2	6–10	 AQ2 – 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.
		• AO1 – 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.
1	1–5	 AO2 – 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 soberence.
		• AO2 Very limited and rarely logical evidence of links between knowledge and
		• AO2 – Very limited and rately logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different
		contexts
		 AO1 – Very limited relevant knowledge and understanding of place(s) and
		environments.
		AO1 – Isolated knowledge and understanding of key concepts, processes and
		interactions and change.
		• AO1 – Very limited awareness of scale and temporal change which is rarely
		integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.



- IGOs can create power imbalances within their structure and organisation, leading to inequalities in decision making.
- UN Security Council only has five permanent member states who can veto decisions made by the Council and UN peacekeeping missions may not be successful.
- WTO favours the free trade model which may put some countries at an economic disadvantage due to the inequality in value between their imports and exports.
- WB and IMF have given loans and other support to some countries to aid development projects. Those countries which do not receive assistance may be at a disadvantage. If these loan conditions (e.g. interest rates) are unfavourable over time, then countries receiving them may increase their level of debt.
- The G7 and OECD are focused on the economic power of their members.

- HDEs dominate decision making in IGOs. USA, UK, Russia, France, and China are permanent members of the UN Security Council with veto powers. African and South American member states plus other member states from Europe, Asia, North America and Oceania only sit on the council on a rotational basis and do not have the power to veto decisions.
- UN peacekeeping missions may have more limited effect in some conflict zones.
- The WTO supports trade liberalisation with the removal of barriers to trade such as tariffs on imports, quotas, and subsidies. This may make it more difficult for some countries to compete fairly in the global market.
- Those countries which do not receive assistance from the WB or IMF may be at a disadvantage. However, if these loan conditions (e.g. interest rates) are unfavourable over time then countries receiving them may increase their level of debt, increasing the inequality of power relations between nation states.
- The G7 and OECD are mainly made up of more economically developed countries.
- Alternative factors including other organisations (national governments, TNCs, trade blocs), location, historical factors, resource endowment, trade, vulnerability to factors such as conflict, natural hazards, climate change and financial shocks can create unequal power relations between states.
- National governments have policies which promote their own national interests.
- Some TNCs have a larger economy than some nation states and their influence (such as location of FDI) can create inequalities between countries.
- Some countries and trade blocs e.g. EU may have some trade restrictions or support their own domestic industries. This can put LDEs at an economic disadvantage as they may not be able to compete fairly in the global trading system.
- Some countries have gained more power due to their strategic location e.g. coastal states have more autonomy over import and export access than landlocked countries.
- Historically, former colonies may have increased levels of dependency and some countries may have benefited from increased investment in the past from foreign powers for strategic reasons e.g. South Korea receiving support from the USA.
- Some countries may have more access to natural, human, financial and technological resources than others, leading to an imbalance of power. This may give them a comparative advantage and so have better access to global trade, increasing their global power.
- Some countries may be more vulnerable to the risks and impacts of conflict, natural hazards, climate change and financial shocks.
- Candidates will use examples to discuss the degree to which IGOs are the most significant factor in creating unequal power relations between states. Their final judgement will depend on the examples



chosen but may argue that although IGOs do contribute to unequal power relations, other factors (e.g. resources, historical factors) have been more important in the creation of this imbalance.

19 AO1 – Knowledge and understanding that the global governance of the global commons, including Antarctica, has an impact on students' lives and those of people around the world. The global commons are areas of the planet and beyond that belong to everyone. They are defined by international law as outside national jurisdictions for all nations, and they are accessible. Global governance of these areas is important so that they have a level of protection and that any activities within them are sustainable in the long term.
AO2 – Application of knowledge and understanding to analyse and evaluate the impact that global governance of the global commons, including Antarctica, on students' lives and those of people around the world. Different groups may have varying levels and types of impact across different timescales.
AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question. AO2 – Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout. AO2 – Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated
		where appropriate.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- The emergence and developing role of norms, laws and institutions in regulating and reproducing global systems.
- Issues associated with attempts at global governance, including how:
 - agencies, including the UN in the post-1945 era, can work to promote growth and stability but may also exacerbate inequalities and injustices
 - interactions between the local, regional, national, international, and global scales are fundamental to understanding global governance.
- Global governance of the global commons affects sustainable development at a range of scales, local, national, and global which will affect students' lives as well as the global population as a whole.

AO2

- Some argue that stronger governance of the global commons as well as the improvement in technology to monitor the success of its policies and so influence the level of sustainable development experienced by people in the future.
- Global governance structures have been criticised for being complex and slow to respond to ongoing issues such as increases in resource consumption from a growing population.
- Individuals and populations may be at increased risk if global governance measures are not robust enough to manage the global commons in future as lack of effective management may increase the chances of conflict and environmental damage.

Antarctica

• The Antarctic Treaty is one of the most successful international agreements, with peaceful cooperation and scientific research between countries. Global research collaboration benefits science worldwide, including increasing knowledge and awareness of the effects of global warming which affects people worldwide.



- The Antarctic Treaty focuses on the protection of resources with the goal of long-term sustainability for many rather than short-term economic gain for the few. This is important in an era with increase demand for resources.
- Both individuals and populations may be affected by the increasing interest in Antarctica by countries with emerging economies and an increasing demand for the mineral, energy and food resources that are present in Antarctica.
- Mechanisms to manage tourism in Antarctica may affect an individual's desire or ability to visit the continent.
- Global governance of Antarctica may increase a student's awareness of the need to protect fragile ecosystems in and around the world's 'last great wilderness'.

High seas

- Global governance such as the United Nations Convention on the Law of the Sea (UNCLOS) aims to regulate the use and resources in the oceans and on the seabed e.g. fish stocks, energy sources, marine bioprospecting. This contributes towards the sustainable development of the oceans which benefits both individuals and populations in the long term.
- However, limitations over its power to resolve claims and disputed territories, as well as the overuse of
 ocean resources, may lead to conflicts between nation states which could lead to political instability,
 affecting the lives of people, particularly in the regions and countries affected.
- Increased protection of the ocean environment through stronger global governance particularly from marine pollution (increased shipping and plastic waste) would improve water quality for those living near the coast.

Atmosphere

- Global governance such as the United Nations Framework Convention on Climate Change (UNFCCC) is important as it sets legally binding international treaties which aim to tackle climate change.
- The main goal of the UNFCCC's Paris Agreement is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels."
- It was adopted by 196 parties, and it is argued that without an overarching organisation such as the UNFCCC, it is highly unlikely that such an agreement would have been reached. Agreements which tackle climate change and mitigating its impacts affects many aspects of lives of students and populations alike (e.g. risk from coastal flooding, impact of extreme weather, food, and water security).
- Global governance of the atmosphere can also focus on atmospheric quality. Measures to reduce gas emissions and particulate matter can help improve the health of students and populations, particularly those that live in urban areas. National and local governance also plays a part here e.g. Clean Air Zones in the UK.

Outer space

- Global governance is vital for outer space as no one country has jurisdiction over it, yet increased space exploration since WWII has made it more accessible.
- The Outer Space Treaty is the foundation for space law which affects many things used in day-to-day life for individuals and populations such as providing satellite and communications technology (vital in the age of the smart phone).
- Space activities are for the benefit for all, and its unique environment provides ideal conditions for scientific exploration e.g. medical research on the International Space Station.



- The Outer Space Treaty also maintains the peaceful use of outer space, key for the vital political stability of the planet.
- Candidates may argue that global governance of the atmosphere is particularly important as climate change is one of the major challenges facing the planet in the foreseeable future. However, others may argue that the resources within all the global commons are highly important, and they must be managed sustainably in the future. Global organisations will be in the best position to do this, provided their policies are robust and enforceable, and so are vital to the future of individual students and populations as a whole.
- **20** AO1 Knowledge and understanding of the Antarctic Treaty System (ATS) and how it manages threats facing Antarctica in the twenty-first century.

AO2 – Application of knowledge and understanding to analyse and evaluate the effectiveness of the Antarctic Treaty System in managing the threats facing Antarctica in the twenty-first century. AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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.
		 AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout.
		 AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout.
		 AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	• AO2 – 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.
		 AO1 – 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.
2	6–10	AO2 – 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.



		• AO1 – 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.
1	1–5	• AO2 – 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.
		 AO1 – Very limited relevant knowledge and understanding of place(s) and environments.
		• AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change.
		• AO1 – Very limited awareness of scale and temporal change which is rarely
		integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- The emergence and developing role of norms, laws and institutions in regulating and reproducing global systems.
- Issues associated with attempts at global governance, including how:
 - agencies, including the UN in the post-1945 era, can work to promote growth and stability but may also exacerbate inequalities and injustices
 - interactions between the local, regional, national, international and global scales are fundamental to understanding global governance.

- The Antarctic Treaty, signed in 1959, provides a framework for how Antarctica is used, with the focus on peace and scientific cooperation.
- The Antarctic Treaty System (ATS) includes additional treaties and conventions where countries agree on matters related to the protection of the Antarctic environment, including plants and animals, preserving historic sites and managing tourism.
- Military activities have been prohibited, so there have not been any major conflicts on the Antarctic continent, and peace and stability have been maintained.
- Environmental preservation includes the banning of mining and the prohibition of nuclear testing and radioactive waste disposal.
- Management of ongoing scientific research is effective as it relies on international cooperation in an extreme environment. Rules are in place to reduce the impact of research on the environment.
- The world has changed in many ways since the treaty was signed in 1959, with twenty-first-century challenges being complex, e.g. climate change, demand for resources, technological advances, changing balance of geopolitical power, effectiveness of large international organisations to make and enforce decisions in an increasingly globalised world.



- The ATS relies on countries following rules and guidelines. If countries do not comply then it is more difficult to enforce rules quickly.
- The ATS has worked successfully in protecting marine environments and species (e.g. CCAMLR) but this may be challenged as demand for resources grows.
- The ATS has limited influence on the causes and management of climate change but experiences its effects.
- It is mainly HICs that are represented in the key decision-making of the ATS. There are calls by other countries to have more representation.
- The authority of the ATS may be challenged in future.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 8

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–4 are point-marked. 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - An insider perspective is the perspective of someone who lives in the place (1).
 - An outsider perspective on a place comes from someone who is visiting or has never been there (1).
 - This perspective may be derived from media representations of a place (1).
 - It may also come from someone who feels they don't belong in a place or feels unwelcome in a place (1).

Example answer: The perspective of someone who lives and has a connection with a place is called an insider perspective. An outsider perspective on a place comes from someone who is visiting or has never been to that place. This perspective may be derived from media representations or from hearsay. It may also come from someone who feels they don't belong in a place or feels unwelcome in a place.

- **2** AO1 = 4
 - Economic characteristics are endogenous factors, which originate internally and relate to the site of a place (1).
 - Employment opportunities can contribute to the character of a place, e.g. places with lots of job opportunities will attract people to a place and contribute to investment in that place.
 - Wealthier areas, where people have access to well-paid employment or other sources of finance, will have a different character to poorer areas, e.g. in relation to crime prevention and the upkeep of the built environment (1).
 - The different economic functions of a place will help define its character, e.g. a vibrant retail centre compared to a coastal village whose economy is based on holiday rentals (1).
- **3** AO1 = 4
 - Place characteristics are influenced by endogenous (such as topography) and exogenous factors (such as flows of people), and maps can be used to present both types of factors (1).
 - For example, modern maps provide accurate representations of economic characteristics such as land use, e.g. agriculture or retail areas (1).
 - Maps can also present the physical geography that contributes to the character of a place, e.g. through the use of contours to represent slopes (1).
 - Maps also record the scale of changes in a settlement, e.g. new housing estates (1).
- **4** AO1 = 4
 - Endogenous factors originate internally and relate to the site of a place, such as location, topography, physical geography, land use, built environment and infrastructure, demographic and economic characteristics (1).



- For example, land use is influenced by physical characteristics of the land itself and can be a major factor shaping a place's character (1).
- For example, the availability of natural resources such as minerals, forests, and water sources often influence the economic activities of a place, influencing place character (1).
- For example, the age, ethnicity, and population density of a place are significant endogenous aspects that contribute to place characteristics (1), though demographic factors are also influenced by exogenous factors (1).

Questions 5–11 are level-marked.

AO1 – Knowledge and understanding of the impact of relationships and connections on people and place.
 AO2 – Application of knowledge to the novel situation to the impact of relationships and connections on people and place.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

A01

- The impact of relationships and connections on people and place.
- How the demographic, socio-economic and cultural characteristics of places are shaped by shifting flows of people, resources, money and investment, and ideas at all scales from local to global.
- How past and present connections, within and beyond localities, shape places and embed them in the regional, national, international and global scales.
- Factors contributing to the character of places exogenous: relationships with other places.

- Figure 1a represents the Sankey Valley in 1831 as a rural place, with land use dominated by agriculture, and a river landscape. One exogenous factor is the railway, which has been constructed to move people and products through this landscape, significantly changing its character.
- The waterway is another form of transport, perhaps reflecting the flow of trade through this place from the products' place of production to their place of consumption.
- Visitors are shown, representing a flow of people who come to this landscape for leisure and relaxation.
- Figure 1b is an aerial photograph of the Nine Arches Viaduct, which is identifiable as the same railway viaduct as shown in Figure 2, identifying a key continuity in the landscape: very useful for investigating the characteristics of this place.



- Figure 1b shows a housing development at the top of the photograph. While we cannot see the same view in Figure 1a (reducing the usefulness of the figures somewhat), it is a modern housing development. This suggests a clear change in the characteristics of this place, from rural to residential.
- Figure 1b shows the waterway running under one of the arches of the Nine Arches Viaduct, just as in Figure 1a. Figure 1b shows no shipping on this waterway, as there was in Figure 1a however, suggesting a change in the use of this landscape. The waterway also seems narrower while in Figure 1a it fills the space between the arch supports, in Figure 1b it occupies only half the space. This may reflect the changing importance of the waterway, which no longer needs to accommodate shipping.
- Figure 1b shows green areas in the bottom half of the photo, just as there are green areas in these locations in Figure 1a. The land use appears different though instead of pasture for cattle, the area is a mix of grass areas (recreational?) and overgrown areas which are possibly returning to the area's climatic climax of oak woodland.

Example answer: The two figures are useful for investigating both change and continuity in the Sankey Valley. Figure1a represents the Sankey Valley in 1831 as a rural place, with land use dominated by agriculture, and a river landscape. One exogenous factor is the railway, which has been constructed to move people and products through this landscape, significantly changing its character. The waterway is another form of transport, perhaps reflecting the flow of trade through this place from their place of production to their place of consumption. Figure 1b is an aerial photograph of the Nine Arches Viaduct, which is identifiable as the same railway viaduct as shown in Figure 1a, identifying a key continuity in the landscape: very useful for investigating the characteristics of this place. Figure 1b shows the waterway running under one of the arches of the Nine Arches Viaduct, just as in Figure 1a. Figure 1b shows no shipping on this waterway, as there was in Figure 1a however, suggesting a change in the use of this landscape. Figure 1b shows a housing development at the top of the photograph. While we cannot see the same view in Figure 1a (reducing the usefulness of the figures somewhat), it is a modern housing development. This suggests a clear change in the characteristics of this place, from rural to residential.

AO3 – Analysis of maps from different eras to identify patterns and anomalies in the data, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of data to support.
		 Clear connection(s) between different aspects of the data.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of data to support.
		 Basic connection(s) between different aspects of the data.

- The settlement of Credenhill has grown significantly between 1938 and 2023, which, in turn, would have attracted more people into what was previously a small rural village.
- The 1938 map names a number of farms in the village. It is unlikely that the new housing indicated on the map for 2023 includes many farmhouses, so Credenhill may have become a residential location for people who work elsewhere, e.g. in Hereford, or possibly at a new place of employment developed in Credenhill since 1938.



- The land use around Credenhill in 2023 appears still to be agricultural, with field boundaries remaining similar in many cases.
- In 1938 a railway line connected Credenhill to other places. In 2023 there is no sign of this railway line. This may have been a cut in railway provision reflecting changes in government priorities.
- 7 AO1 Knowledge and understanding of the importance of the meanings and representations attached to places by people.

AO2 – Application of knowledge to the novel situation to evaluate the importance of different perspectives on place meaning.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions, change. AO2 – Applies limited knowledge and understanding to the novel situation offering basic analysis and evaluation drawn from the context provided. Connections and relationships between different aspects of study are basic with limited relevance.

A01

- How humans perceive, engage with and form attachments to places and how they present and represent the world to others, including the way in which everyday place meanings are bound up with different identities, perspectives, and experiences.
- How external agencies, including government, corporate bodies and community or local groups make attempts to influence or create specific place meanings and thereby shape the actions and behaviours of individuals, groups, businesses and institutions.
- How places may be represented in a variety of different forms such as advertising copy, tourist agency
 material, local art exhibitions in diverse media (e.g. film, photography, art, story, song etc) that often give
 contrasting images to those presented formally or statistically such as through cartography and census
 data.
- How both past and present processes of development can be seen to influence the social and economic characteristics of places and so be implicit in present meanings.

- Yi-Fu Tuan sees the emotional investment that people make in a place as critical to how space becomes place. That emotional investment comes from living in a place and associating with it.
- Tuan also sees a person's position in society as influencing how meanings are made. This can lead to different perspectives on space depending on our social position and our identities.


- Parliament is a place where laws are made. It is a place where protesters are not allowed but Westminster Bridge is a public place that is associated with Parliament because of its proximity (in the background in the photo) to the Houses of Parliament, so its place meaning is affected by that perspective.
- In contrast, the perspective of the poet is different. Here the bridge is given meaning as the viewpoint where a mighty city and its river come together. The poet is reflecting on what London as a place means to him from this viewpoint. Many English people at that time would also feel a connection to this personal viewpoint and his feeling of pride in London.
- However, factors other than different perspectives are involved in place meaning. For example, the poet recognises that this moment on Westminster Bridge is not typical. London is sleeping, smoke-free and 'glittering' because it is early morning. So, place meaning is affected by this being an unusual and exceptional moment.
- Place meaning also has cultural and historic influences. It is possible that protesters choose Westminster Bridge because of its association with a famous poem by Wordsworth, for example. It might have particular meaning because of the association between the River Thames and migration to London through the centuries.
- 8 AO1 Knowledge and understanding of the importance of the meanings and representations attached to places by people.

AO2 – Application of knowledge to the novel situation to evaluate the importance of different perspectives on place meaning.

AO1 = 2 AO2 = 4

Level	Marks	Description
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. AO2 – Applies knowledge and understanding to the novel situation offering clear analysis and evaluation drawn appropriately from the context provided. Connections and relationships between different aspects of study are evident with clear relevance.
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A01

- How humans perceive, engage with and form attachments to places and how they present and represent the world to others, including the way in which everyday place meanings are bound up with different identities, perspectives, and experiences.
- How external agencies, including government, corporate bodies and community or local groups make attempts to influence or create specific place meanings and thereby shape the actions and behaviours of individuals, groups, businesses and institutions.
- How places may be represented in a variety of different forms such as advertising copy, tourist agency
 material, local art exhibitions in diverse media (e.g. film, photography, art, story, song, etc) that often give
 contrasting images to those presented formally or statistically such as through cartography and census
 data.



• How both past and present processes of development can be seen to influence the social and economic characteristics of places and so be implicit in present meanings.

AO2

- Rebranding a place refers to changing or influencing the image or perception of a place to make it more attractive or appealing, usually for economic or social objectives. Reimagining a place goes beyond the reshaping of rebranding. It involves creating new place meanings by the rethinking of place functions, meanings, and purposes.
- Rebranding is generally, though not always, top-down, involving local government and marketing agencies. Reimagining can be more bottom-up, sometimes driven by the grassroots of a community.
- Pentre Awel is an example of reimagining because it is about a change in place function. The place meaning that is being created is a complex one, combining scientific research, job creation, training, health care and recreation. Because of this complexity, it is difficult to understand what place meaning is being created here.
- The image used is very low key; perhaps intended to indicate a place that is in harmony with its natural surroundings rather than imposing on them. The choice of near-dark conditions is an interesting one, as is the absence of any human figures.
- The example of Pentre Awel shows the difficulties involved for external agencies in creating or influencing new place meanings. Successful examples of reimaging, such as the High Line in New York City, have a clear identity that people can connect with and identify with. However, successful reimagining, like the High Line, is often associated with bottom-up, community-led development, rather than being imposed by external agencies.
- This suggests that influencing or creating specific place meanings should have a clear focus on how people understand the place and engage with it. People need to feel a connection to a space before it becomes a place for them.
- **9** AO1 Knowledge and understanding of changing demographic and cultural characteristics or economic change and social inequalities for a contrasting place study; knowledge and understanding of the impact of relationships and connections on people and place.

AO2 – Application of knowledge and understanding to a critical assessment of the impact of government policies on people's connections with place.

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.



3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
U	U	Nothing worthy of credit.

- Contrasting place study exploring the developing character of a contrasting and distant place: people's lived experience of the place in the past and at present and either changing demographic and cultural characteristics or economic change and social inequalities.
- How the demographic, socio-economic and cultural characteristics of places are shaped by shifting flows of people, resources, money and investment, and ideas at all scales from local to global.



- The characteristics and impacts of external forces operating at different scales from local to global, including either government policies or the decisions of transnational corporations or the impacts of international or global institutions.
- How past and present connections, within and beyond localities, shape places and embed them in the regional, national, international, and global scales.

AO2

- Answers should relate to a specific place study, the contrasting place study to your local place study. This answer relates to Boston, Lincolnshire.
- The decision to allow free movement of labour within the EU when the UK was an EU member impacted Boston as the place was very attractive to Eastern European migrants. There were significant and rapid demographic changes (18.1 per cent of the population was from other EU countries, predominantly Lithuania and Poland by 2021) and this affected the local job market, culture, and social dynamics.
- However, while government policy facilitated migration, these impacts were also affected by endogenous factors in Boston: its location in the east of the UK but primarily the opportunities there for employment in agriculture and food processing, and the long history of employment of migrants in those industries.
- Historic policies that allowed the draining of the Fens shaped Boston's agricultural prospects and its eventual development into a prosperous farming and food processing region. This shows that connections to place evolve over time and are not solely determined by government policies.
- The strong vote for Brexit in Boston (74.9 per cent) reflects local sentiment towards EU policies on immigration, perceived as having led to uncontrolled immigration and pressure on services and infrastructure. This is evidence of government policy to an extent, in that the referendum on EU membership was called by the government, although the government at the time campaigned against leaving.
- Data on health, income deprivation, unemployment, professional demographics, education levels, pay, and crime rates all suggest that governmental policies in these areas play significant roles in shaping the living conditions and hence the character of place.
- Nonetheless, the persistent economic and social challenges in Boston indicate the impact of government policy can be limited or shaped by other factors, such as global economic trends, local culture, and individual choices.
- The shift in local administration to the Boston Independent Group following Brexit dissatisfaction shows how political shifts can be a response to national policies' local impact.
- Efforts to restore civic pride and 'put Boston back on the map' are acknowledgments that local government can also shape connections to place through policy initiatives aimed at addressing local concerns. This suggests, however, an example of people's connections to place impacting on government policy, rather than the other way round.

Example answer: When the UK was still part of the EU, the decision to allow free movement of labour within the EU made Boston very attractive to Eastern European migrants. There were significant and rapid demographic changes, and this affected the local job market, culture and social dynamics – by 2021, 18.1 per cent of the population was from other EU countries, mainly Lithuania and Poland. While government policy facilitated migration, these impacts were also affected by endogenous factors – Boston's location in the east of the UK but primarily the opportunities for employment in agriculture and food processing, and the long history of employment of migrants in those industries. Historic policies that allowed the draining of the Fens shaped Boston's agricultural prospects and its eventual development into a prosperous farming and food processing region. This shows that connections to place evolve over time and are not solely determined by government policies.



The strong vote for Brexit in Boston (74.9 per cent) reflects local sentiment towards EU policies as having led to uncontrolled immigration and pressure on services and infrastructure. This is evidence of government policy to an extent, in that the referendum on EU membership was called by the government, although the government at the time campaigned against leaving.

Data on health, income deprivation, unemployment, professional demographics, education levels, pay, and crime rates all suggest that governmental policies in these areas play significant roles in shaping the living conditions and hence the character of place. Nonetheless, the persistent economic and social challenges in Boston indicate that the impact of government policy can be limited or shaped by other factors, such as global economic trends, local culture, and individual choices.

The shift in local administration to the Boston Independent Group following dissatisfaction with Brexit shows how political shifts can be a response to national policies' local impact. Efforts to restore civic pride and 'put Boston back on the map' are acknowledgments that local government can also shape connections to place through policy initiatives aimed at addressing local concerns. This suggests, however, an example of people's connections to place impacting on government policy, rather than the other way round.

10 AO1 – Knowledge and understanding of a local place study exploring the developing character of a place local to the home or study centre.

AO2 - Application of knowledge and understanding from local place study to an assessment of the extent to which different sources reflect change and/or continuity in this place.AO1 = 2 AO2 = 4

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout.
		 AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.
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- Local place study exploring the developing character of a place local to the home or study centre.
- Place studies must apply the knowledge acquired through engagement with prescribed specification content and thereby further enhance understanding of the way students' own lives and those of others are affected by continuity and change in the nature of places. Sources must include qualitative and quantitative data to represent places in the past and present.
- Both place studies must focus equally on people's lived experience of the place in the past and at present and either changing demographic and cultural characteristics or economic change and social inequalities.

- Answers should relate to a specific place study, the contrasting place study to your local place study.
- Sources have strengths and limitations for representing the influences of changes.
- For example, 'before and after' photographs provide an accurate representation of change. But photos are taken from a subject viewpoint and may exclude influences of change.
- For example, text gives personal and emotional context and offers historical perspectives on the influences, but it is also subjective, based on personal experiences and not always generalisable.



- For example, statistics such as census data allow objective representations and comparisons of different demographics and employment types, levels of education, etc., which are very useful in identifying the influences of changes over time. However, statistics can be manipulated; they can give a skewed perspective if only a narrow range of results is viewed, and not all changes are represented in the range of statistics collected over time.
- Answers should consider these types of strengths and limitations in relation to local place study findings.
- **11** AO1 Knowledge and understanding of the importance of the meanings and representations attached to places by people.

AO2 – Application of knowledge and understanding to evaluate the extent to which people's different socioeconomic status explain different perceptions of place.

AO1=10 AO2=10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- Insider and outsider perspectives on place.
- How humans perceive, engage with and form attachments to places and how they present and represent the world to others, including the way in which everyday place meanings are bound up with different identities, perspectives, and experiences.
- How external agencies, including government, corporate bodies and community or local groups make attempts to influence or create specific place meanings and thereby shape the actions and behaviours of individuals, groups, businesses and institutions.
- How places may be represented in a variety of different forms such as advertising copy, tourist agency
 material, local art exhibitions in diverse media (e.g. film, photography, art, story, song, etc) that often give
 contrasting images to those presented formally or statistically such as through cartography and census
 data.
- How both past and present processes of development can be seen to influence the social and economic characteristics of places and so be implicit in present meanings.

- Socio-economic status clearly influences experiences of places, since wealthy people are able to afford better housing, better education, health, transportation opportunities, environment and lifestyles. Children from wealthier families could be expected to have more positive experiences of places too. Experiences of places are key to forming perspectives about places.
- Insider and outsider perspectives: an insider perspective is the perspective of someone who lives in the place; an outsider perspective on a place may result from a range of scenarios, including being the perspective of someone who feels they don't belong in a place or feels unwelcome in a place. Different socio-economic status can therefore produce insider and outsider perspectives.
- For example, some spaces are not open to everyone: the privileged (the wealthy) may get to experience them directly while others (the deprived) are kept out.



- Media representations can reinforce these sorts of insider and outside perspectives, for example by representing an economically deprived place as associated with crime and anti-social behaviour so that wealthier people would avoid such places because of their negative perspectives about them.
- However, many other factors are also involved in creating different perspectives of places, e.g. communities may feel connected to a place because of cultural factors such as a football team, a festival or a retail experience. These connections can create a positive perception of place that cuts across socio-economic differences.
- The actions of external agencies can also influence perceptions and even change perceptions about places, for example through rebranding and reimagining.
- Individual experiences, such as childhood memories or significant life events tied to specific places, can greatly influence perception, regardless of current socio-economic status. So perhaps socio-economic status is less influential than might at first be thought.
- **12** AO1 Knowledge and understanding of how demographic, socio-economic, and cultural characteristics of places are shaped by shifting flows of people.

AO2 - Application of knowledge and understanding to assess the extent to which demographic characteristics or patterns of social inequality are influenced by shifting flows of people.AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question.



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- Local place study exploring the developing character of a place local to the home or study centre.
- Contrasting place study exploring the developing character of a contrasting and distant place: people's lived experience of the place in the past and at present and either changing demographic and cultural characteristics or economic change and social inequalities.
- How the demographic, socio-economic and cultural characteristics of places are shaped by shifting flows of people, resources, money and investment, and ideas at all scales from local to global.
- The characteristics and impacts of external forces operating at different scales from local to global, including either government policies or the decisions of transnational corporations or the impacts of international or global institutions.
- How past and present connections, within and beyond localities, shape places and embed them in the regional, national, international, and global scales.

- Answers should relate to a specific place study, the contrasting place study to your local place study. This answer relates to Withington, Manchester and Boston, Lincolnshire.
- Because of the specification's requirements, your answer will relate to **either** demographic characteristics **or** patterns of social inequality. This answer attempts to provides notes relevant to both, but your answer should pick either demographic characteristics or patterns of social inequality.
- Boston, Lincolnshire: demographic characteristics: the increase in Eastern European migrants, particularly after the expansion of the EU in 2004, produced a rise in the working-age population and increased



cultural diversity (for example, a substantial portion of the population speaking languages other than English as their first language).

- Boston, Lincolnshire: patterns of social inequality: the arrival of migrants looking for work in agriculture and food processing industries may have contributed to wages remaining low in unskilled areas and higher competition for these unskilled and low-paid jobs. This can be linked to social deprivation: of the 36 neighbourhoods in Boston, six were among the most income-deprived in England, while two were in the 20 per cent of least income-deprived neighbourhoods in England.
- Withington, Manchester: demographic characteristics relating to studentification and gentrification. A transient student population significantly influences the local demographic. Gentrification may also lower the age profile of a place as young families relocate. This is shown in the high proportion of 20–29-year-olds living in Withington at the time of the last census.
- Patterns of social inequality: a high student population can affect housing markets, often driving up rent prices, which can displace long-term residents, contributing to gentrification. Competition for temporary and zero-hour contract work is affected by large student populations also. Gentrification pushes up house prices and rental prices, which can reduce social inequality by pushing poorer people out of the area.
- **13** AO1 Knowledge and understanding of a local place study exploring the developing character of a place local to the home or study centre.

AO2 – Application of knowledge and understanding from local place study or distant place study to an assessment of the effectiveness of maps at representing the changing character of a place over time. AO1=10 AO2=10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 - 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. AO1 - 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.



2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- Place studies must apply the knowledge acquired through engagement with prescribed specification content and thereby further enhance understanding of the way students' own lives and those of others are affected by continuity and change in the nature of places. Sources must include qualitative and quantitative data to represent places in the past and present.
- Both place studies must focus equally on people's lived experience of the place in the past and at present and either changing demographic and cultural characteristics or economic change and social inequalities.

- Answers should relate to a specific place study, either your local place study or the contrasting place study to your local place study.
- Traditional maps are often static, representing a snapshot in time. They may not effectively convey the process of change or the nuances of a place's character, such as social transformations or cultural shifts. Other sources may be more effective at representing these types of change, such as oral sources, texts, photos, and artistic representations.
- Geospatial data, such as GIS and interactive maps, can effectively illustrate changes over time through layers, animations, and other dynamic features. These tools can incorporate information on demographic shifts and economic changes, increasing the effectiveness of their representations of change.



- Maps are very effective in showing changes in physical geography, land use and built environment. For example, maps of Withington could effectively show the expansion of university campus facilities or the reduction in industrial areas over time. Historical maps of Lincolnshire could show the development from marshland to agricultural land after the Fens were drained, which is a significant alteration in the character of the place.
- While maps might show areas of affluence versus deprivation, they may not fully capture the day-to-day realities of these disparities, or the underlying causes of social change brought on by events like Brexit. Other sources could be more effective at representing these changes, such as interviews and audio-visual media.
- While maps may not be able to convey all aspects of a place's character and its changes over time, especially more abstract qualities, they are nonetheless a powerful tool for visualising many types of change.

14 AO1 – Knowledge and understanding of the factors contributing to the character of places and affecting continuity and change in the nature of places and our understanding of place.
 AO2 – Application of knowledge and understanding of the factors contributing to change in the nature of places to assess the importance of mitigating the impacts of climate change as a process of change for local places.

AO1=10 AO2=10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11-15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies
0	0	Nothing worthy of credit.

- Factors contributing to the character of places:
 - Endogenous: location, topography, physical geography, land use, built environment and infrastructure, demographic and economic characteristics.
 - Exogenous: relationships with other places.
- In relation to the local place within which students live or study and then at least one further contrasting place and encompassing local, regional, national, international, and global scales:
 - the ways in which the following factors: relationships and connections, meaning and representation, affect continuity and change in the nature of places and our understanding of place.
 - the ways in which students' own lives and those of others are affected by continuity and change in the nature of places and our understanding of place.

AO2

However, the extent to which mitigation drives change will depend on government policy and public
response to it. For example, the introduction of low emission zones in cities like London have produced
significant changes in people's connections to local places, such as people experiencing cleaner air, making
more journeys on foot, scooter or bike instead of cars, which increases interaction with the local area.
However, such policies also generate opposition and lead to contested ideas about how much change
communities can tolerate or welcome in their places. For example, making it harder to travel by car or
penalising older cars may impact more on lower income groups who may travel further to work.



- Economic processes could also be argued as likely to continue to be the most important process for change: to date, few countries have been willing to reduce economic growth in order to mitigate the impacts on places of climate change.
- 15 AO1 Knowledge and understanding of different sources used in local place study and their usefulness.
 AO2 Application of knowledge and understanding to evaluate the usefulness of different sources in a local place study.

AO1=10 AO2=10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.



- Students must engage with a range of quantitative and qualitative approaches across the theme as a whole. Quantitative data, including the use of geospatial data, must be used to investigate and present place characteristics, particular weight must be given to qualitative approaches involved in representing place, and to analysing critically the impacts of different media on place meanings and perceptions. The use of different types of data should allow the development of critical perspectives on the data categories and approaches.
- Local place study exploring the developing character of a place local to the home or study centre.

AO2

- Answers will depend on local place study.
- Sources have strengths and limitations for representing the influences of changes.
- For example, 'before and after' photographs provide an accurate representation of change. But photos are taken from a subject viewpoint and may exclude influences of change.
- For example, text gives personal and emotional context and offers historical perspectives on the influences, but it is also subjective, based on personal experiences and not always generalisable.
- For example, statistics such as census data allow objective representations and comparisons of different demographics and employment types, levels of education, etc., which are very useful in identifying the influences of changes over time. However, statistics can be manipulated; they can give a skewed perspective if only a narrow range of results is viewed, and not all changes are represented in the range of statistics collected over time.
- Answers should consider these types of strengths and limitations in relation to local place study findings.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 9

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–8 are point-marked. 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Deindustrialisation can cause decline of traditional manufacturing industries in urban areas (1).
 - Urban decay when sites are underused or abandoned (1).
 - Redevelopment of former industrial sites (1).
 - Governments may prioritise urban renewal to stimulate investment to revitalise urban areas (1).
 - Buildings can be repurposed for new uses (1).
 - Employment restructuring as unemployed secondary workers retrain for tertiary and quaternary sector jobs, sometimes in areas of the city that have undergone urban renewal, e.g. retail parks (1).
 - Younger workforce may out-migrate to find work, ageing the population in urban areas.
 - Governments may prioritise urban renewal to stimulate investment to revitalise urban areas (1).

Example answer: Deindustrialisation leads to the decline of traditional manufacturing industries in urban areas (e.g. inner city or on the edge of cities). Sites are abandoned and buildings become derelict, leading to urban decay. These sites can also be redeveloped for new land uses and economic activities, e.g. residential, retail or office space. Industrial buildings can be repurposed or demolished and replaced by new builds. Governments may prioritise urban renewal to stimulate investment to revitalise urban landscapes. Deindustrialisation can lead to unemployment, lowering workers' standard of living or workers can retrain for jobs in the service and quaternary sectors, with these sectors located in areas of the city that have undergone urban renewal, e.g. retail parks. Deindustrialisation can lead to demographic changes if the younger workforce out-migrates to find work, ageing the population in urban areas.

2 AO1 = 4

- Social segregation is the spatial and social division of different groups within an area (1).
- Residential segregation occurs when housing patterns reflect economic inequality (1).
- The housing market can lead to concentrations of lower income and higher income populations in different parts of the city (1).
- Different life-cycle stages may require different types of housing (1).
- Gentrification can displace lower income residents as property values and rents rise (1).
- Communities from different social groups may concentrate in areas for historical, cultural reasons (1).
- Immigrants (internal and international) may choose to live in communities with similar ethnic and linguistic backgrounds (1).

3 AO1 = 4

- Hard, impermeable surfaces reduce infiltration and increase surface runoff (1).
- Vegetation and soils in urban areas increase infiltration and reduce surface runoff (1).
- Drainage systems remove surface runoff (1).
- Technology can improve permeability (1).



4 AO1 = 4

- Urban areas are dynamic. The use of buildings and open spaces within urban areas changes over time. When they fall into disrepair or are abandoned, this leads to environmental problems such as air, water, land, and visual pollution (1).
- Building materials can be declared unsafe e.g. asbestos (causing respiratory problems), RAAC (increased risk of collapse of structures) and some forms of external cladding (increasing fire risks) reducing the environmental quality of the area (1).
- Derelict former industrial buildings and the land they are situated on may contain toxic substances which may seep into water courses and local habitats (1).
- 'Broken windows theory' when buildings fall into disrepair, visible signs of neglect such as broken windows, can lead to lack of investment in neighbouring buildings, causing a larger area within the neighbourhood to be neglected (1).
- Dereliction through 'Planning blight' (delays in plans for redevelopment leaves buildings empty over time) can lead to lack of investment in an urban area and decrease its environmental quality (1).
- Abandoned and neglected buildings can increase the risk of damage from vandalism and graffiti, fly tipping and littering, or higher rates of other crimes, increasing environmental problems (1).
- Built environments can also decay through time due to weathering and use, particularly if there is a lack of maintenance and repair (1).
- Historic buildings may be more complex and costly to repair if they become derelict, reducing the environmental quality of neighbourhoods (1).

5 AO1 = 4

- Waste streams, the flow of waste from its source through to its recovery, recycle or disposal, are linked to characteristics of a population in different ways (1).
- Waste streams include domestic and industrial waste and the volume of these may be higher, and the type of waste different in a wealthier society compared to a less wealthy society (1).
- Populations with higher incomes are able to afford more products and so may produce higher levels of waste (1).
- Populations with a consumer lifestyle may use more products or may change products more frequently, causing increased levels of waste (1).
- Populations with a more environmentally conscious attitude may reuse and recycle products more readily and pressurise governments to improve waste recycling and disposal methods (1).

Questions 6–18 are level-marked.

6 AO3 – Analysis of the changes in urban population by group of economies between 2011 and 2021 to identify patterns and anomalies, using data manipulation to support response.
 AO3 = 6

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

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

AO3

- In Figure 1, all groups show an increase in proportion of urban population between 2011 and 2021.
- Urbanisation has been most significant between 2011 and 2021 in developing economies.
- In Asia/Oceania, the percentage of urban population increased from 43 per cent in 2011 to 50 per cent in 2021, whereas Africa has seen around 4 per cent rise in the same decade.
- Urbanisation in the developing economies of the Americas has increased from around 78 per cent to 81 per cent and is comparable to levels of urbanisation in developed economies.
- Developed economies show a slight increase from 77 per cent to 79 per cent.
- In Asia/Oceania and Africa, urban population levels remain lower; in Asia/Oceania, 50 per cent of the population lived in non-urban areas (i.e. rural areas) in 2021, with Africa's rural population being 57 per cent in 2021.

Example answer: Figure 1 shows urban population by group of economies. All groups show an increase in the proportion of urban population between 2011 and 2021. Urbanisation has been most significant in developing economies, in particular Asia and Oceania, which saw the percentage of urban population increase from 43 per cent in 2011 to 50 per cent in 2021. Africa saw an increase of around 4 per cent in the same decade. Urbanisation in the developing economies of the Americas increased around from 78 per cent to 81 per cent and is comparable to levels of urbanisation in developed economies, which rose from 77 per cent to 79 per cent. As the non-urban population is the rural population, the data indicates that 50 per cent of Asia's population and 57 per cent of Africa's population of the population lived in rural areas in 2021.

AO3 – Analysis of the number and location of megacities between 2018 and 2030 to identify patterns and anomalies, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	Clear analysis of the quantitative evidence provided, which makes appropriate
		use of data to support.
		Clear connection(s) between different aspects of the data.
1	1–3	Basic analysis of the quantitative evidence provided, which makes limited use of
		data to support.
		Basic connection(s) between different aspects of the data.

- Figure 2 shows the megacities in the world in 2018 and new megacities in 2030.
- In 2018, megacities were situated in every continent other than Oceania and Antarctica.
- In both 2018 and in 2030, most were/will be situated in South and East Asia.
- In 2030, it is estimated that there will be 10 new megacities, with most being in Asia (6) including India and China.
- Number of megacities in Africa will double (adding Luanda and Dar es Salaam).
- Europe will have one new megacity (London).
- None in the Americas as urbanisation rates are declining.



8 AO3 – Analysis of air quality data for the top five air polluted cities in the early 2020s to identify patterns and anomalies in the data, using data manipulation to support response.
 AO3 = 6

Level	Marks	Description
2	4–6	Clear analysis of the quantitative evidence provided, which makes appropriate
		use of data to support.
		Clear connection(s) between different aspects of the data.
1	1–3	Basic analysis of the quantitative evidence provided, which makes limited use of
		data to support.
		Basic connection(s) between different aspects of the data.

AO3

- Figure 7 shows levels of air quality using particulate matter (PM2.5) data. The higher the value, the poorer the air quality.
- Values shown for each month of the year in 2022 as well as yearly average for 2020, 2021 and 2022.
- Top five cities are all situated in Asia: two in Pakistan, two in India and one in China.
- City ranked 1, Lahore, has levels of 97.4 in 2022.
- All top five countries exceeded WHO guidelines by over 10 times in 2022.
- Hotan and Peshawar's levels exceed WHO guidelines by over 10 times for all months of the year in 2022.
- Levels decrease in July and August for Lahore, Bhiwadi and Delhi (also September).
- Delhi is the only city in the top five with values that exceed WHO guidelines by 5 to 7 times, rather than above 7 times.
- The top five cities experience their highest levels in different months. Lahore's highest level is December and continues over the winter months. Delhi also experiences high levels of PM2.5 in winter (highest November), as does Peshawar (December).
- Levels in Hotan and Bhiwadi also fluctuate more widely throughout the year.
- All cities' yearly average exceeded limits by over 10 times in 2021 and 2020 (except Peshawar, where there was no data available for 2020).
- Between 2021 and 2022, yearly averages for PM2.5 readings had increased for Lahore and Peshawar, but had declined for Hotan, Bhiwadi and Delhi.
- Hotan's yearly averages for PM2.5 readings has dropped the most from 2020 (110.2 to 94.3).
- **9** AO1 Knowledge and understanding of how demographic processes are leading to the growing number of megacities.

AO2 - Application of knowledge and understanding to analyse and evaluate the extent to which demographic processes are leading to the growing number of megacities.AO1 = 4 AO2 = 5

AU1 = 4 AU2 = 5

Level	Marks	Description
3	7–9	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.

		REVISE
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

- Urbanisation, suburbanisation, counter-urbanisation, urban resurgence. The emergence of megacities and world cities and their role in global and regional economies.
- Economic, social, technological, political and demographic processes associated with urbanisation and urban growth.

AO2

- Evaluation of the role of demographic processes in the growth of megacities.
- Demographic processes have an important role in the growth of megacities.
- Demographic processes are linked to natural increase and migration.
- Migration is highly important, especially rural to urban migration in parts of Africa and Asia, and international migration, linked to globalisation, can also increase megacity growth.
- Migration leads to growth of cities with populations of greater than 10 million with high population densities.
- Migration from small towns within a country also increases population in megacities.
- Natural increase within megacities also contributes to their growth. Migrants tend to be younger and so
 more likely to have children, increasing or at least maintaining birth rates, and may increase total fertility
 rates above replacement rate of 2.1. Access to food and health services may be better than rural areas,
 decreasing death rates, particularly among children. Thus, birth rates are higher than death rates, causing
 natural increase and so contributing to population growth in megacities.
- Other processes apart from demographics play an important role.
- Increased economic activity (e.g. manufacturing and services), plus the growth of TNCs, provide employment opportunities for migrants, which then in turn increases populations of megacities.
- Government policies may also stimulate growth in megacities, e.g. free trade zones. Transportation (e.g. ports) and communication technology (e.g. broadband) are also important for megacities to grow.
- Location also affects the growth of megacities (e.g. available flat space, coastal locations, water supply).
- Candidates should come to an overall conclusion that assesses how demographic processes influence the growth of megacities.

Example answer: The growth of megacities can be the result of a number of different processes, including demographic, economic, social, technological and political. On the one hand, demographic processes play a key role in the population growth of megacities. Migration, particularly rural to urban migration in parts of Africa and Asia, has a significant influence on megacity expansion. This internal migration from rural regions to urban areas, as well as population movements from smaller towns, particularly in EMEs and LDEs, adds to the urban

ISBN 9781382052429



population. International migrants can also contribute to the rapid growth of megacities, leading to populations exceeding 10 million with high population densities.

Furthermore, natural increase within megacities is another demographic process influencing their growth but may contribute less to the increase of megacities' populations than migration, particularly in the short term. Migrants, who are typically younger, tend to have higher fertility rates, contributing to a higher birth rate compared to death rates within urban areas. Improved access to food and health services in megacities, when compared to rural areas, further reduces mortality rates, especially among children, resulting in a net natural increase in population, causing megacities to grow.

However, there are other processes that contribute to the growth of megacities. Increased economic activity, driven by sectors such as manufacturing and services, as well as the growth of Transnational Corporations (TNCs), provide employment opportunities that attract migrants to urban areas. Social factors rather than economic ones may drive migrants to megacities, e.g. joining friends and family in a particular city. Government policies, such as the establishment of free trade zones, can stimulate economic growth and urbanisation.

Moreover, the availability of infrastructure, including transportation hubs, e.g. ports, and advanced communication technology, such as broadband, are critical for the growth of megacities. The geographical location of a city, with consideration of factors like available flat space, coastal proximity and water supply, also influences the potential for growth of megacities.

Overall, demographic processes like migration and natural increase are significant contributors to the growth of megacities, particularly in terms of their population size and especially in LDEs and EMEs in parts of Asia and Africa. However, other factors can influence megacity growth. Economic activities, government policies, and geographical considerations also have a key role to play in the growth of megacities.

10 AO1 – Knowledge and understanding of how new urban landscapes, such as town centre mixed developments, cultural and heritage quarters and fortress developments lead to cultural diversity.
 AO2 – Application of knowledge and understanding to analyse and evaluate the extent to which new urban landscapes, such as town centre mixed developments, cultural and heritage quarters and fortress developments leads to cultural diversity.
 AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	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.
2	4–6	AO1 – Demonstrates clear knowledge and understanding of concepts, processes,
		interactions and change. These are mostly relevant though there may be some
		minor inaccuracy.
		AO2 – Applies clear knowledge and understanding appropriately. Connections
		and relationships between different aspects of study are evident with some
		relevance. Evaluation is evident and supported with clear and appropriate
		evidence.



1	1–3	AO1 – Demonstrates basic knowledge and understanding of concepts, processes,
		interactions and change. This offers limited relevance with inaccuracy.
		AO2 – Applies limited knowledge and understanding. Connections and
		relationships between different aspects of study are basic with limited relevance.
		Evaluation is basic and supported with limited appropriate evidence.

- Physical and human factors in urban forms. Spatial patterns of land use, economic inequality, social segregation and cultural diversity in contrasting urban areas, and the factors that influence them.
- New urban landscapes: town centre mixed developments, cultural and heritage quarters, fortress developments, gentrified areas, edge cities. The concept of the post-modern western city.

AO2

- Evaluation of how new urban landscapes: town centre mixed developments, cultural and heritage quarters and fortress developments influence cultural diversity.
- Cultural diversity includes the range of different groups within a society. These groups may be linked to race, ethnicity, sexual orientation, religion, language, gender, age, disability and socioeconomic status.
- Town centre mixed developments do affect patterns of cultural diversity:
 - Multifunctional zones with a range of residential, retail, commercial and leisure spaces, attracting a broad range of cultures.
 - Different amenities and services provided, e.g. recreational facilities which appeal to people from differing backgrounds.
 - Planners include access to these by people from different cultures in their redevelopment plans. Some land uses, e.g. universities, increase likelihood of increased diversity.
 - Town centre mixed developments have less impact on patterns of cultural diversity:
 - Some groups may be forced to relocate when redevelopment has taken place or are priced out of new city centre housing.
 - Affordable housing in mixed developments in town centres may be limited, so younger economically active and wealthy retirees may favour residential areas in city centres.
- Cultural and heritage quarters do affect patterns of cultural diversity:
 - Intentional planning and design to show cultural and heritage aspects of a place to encourage tourism and investment.
 - Access to museums, galleries, festivals and events attracts residents who engages with these activities.
- Cultural and heritage quarters have less impact on patterns of cultural diversity:
 - May be too artificial attracting tourists only so local businesses more focused on them rather than local communities; increases prices of land and rents.

Fortress developments do affect patterns of cultural diversity

- Uses defensible space design and security (gates, CCTV, AI) which increases safety for users.
- Polarises different income groups as higher income residents can afford to pay for the technology and for the homes within these developments, so discouraging social mixing and limited interaction between different income groups.
- Physical barriers e.g. gates fragment different communities within an urban area.

Fortress developments have less impact on patterns of cultural diversity



- Polarises by income rather than ethnicity so can still be culturally diverse in terms of ethnicity and language.
- 11 AO1 Knowledge and understanding of how economic inequality and social segregation has an impact on 'liveability' in urban areas.

AO2 – Application of knowledge and understanding to analyse and evaluate the importance of how economic inequality and social segregation has an impact on liveability in urban areas.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

AO1

- Liveability is the combination of factors that affect an urban community's quality of life. These factors are varied but may include environmental, economic, social and political factors.
- How does economic inequality and social segregation impact liveability in urban areas

- Evaluation of the importance of how economic inequality and social segregation affects liveability in urban areas.
- Economic inequality does have an impact on liveability:
- Economic inequality can affect access to basic services, affordability of housing, quality of infrastructure, and crime and safety
- Economic prosperity through income generation allows people to access goods and services and rent or • buy housing.
- Having lower income levels makes some housing in cities unaffordable for some. The employment ٠ opportunities available in the city may affect whether or not people can afford to live in (or near to) the city.
- The built environment is a key part of the physical fabric of the city as many urban activities take place • within them. Economic inequality may lead to varying levels of investment in urban areas. Buildings which



are safe and fit for purpose, whether historic or modern contribute to the liveability of an area. Derelict neighbourhoods may not attract investment, increasing income inequality within the city.

 Governments may target areas of economic deprivation for urban regeneration projects in an attempt to improve liveability.

Social segregation does have an impact on liveability:

- The built environment creates a sense of place and identity. Areas which are segregated may provide familiarity for some but apprehension for others, affecting their perception of liveability.
- Access to key services such as education and health are important for the long-term sustainability of the city and the quality of life for its residents. Other local services such as libraries and sports facilities are a priority for some, whereas cultural and entertainment opportunities are an important contributor to liveability for others. Social segregation may improve access to these for some but may act as a barrier to key services for others.
- Segregated neighbourhoods can lead to polarisation of communities, weakening social cohesion and negatively affecting liveability.

Economic inequality and social segregation have less impact on liveability.

- The natural environment such as green (e.g. parks) and blue (e.g. rivers) spaces within the city are important for mental and physical health for all groups within the city, therefore have an important impact on liveability. Public spaces may have equal access for all, reducing the importance of economic inequality and social segregation on liveability.
- Some might argue that a safe, secure environment is the most important factor, as without this businesses and services cannot function and people would be worse off.
- Different individuals, groups and organisations will have different views and attitudes towards which factors contribute most to their quality of life in the city.
- Political factors such as the opportunities for community engagement and participating in decision making at a local level are of value for some people and groups.
- Candidates should come to an overall conclusion that assesses the importance of different factors affecting liveability in urban areas.
- **12** AO1 Knowledge and understanding of strategies to improve environmental sustainability in contrasting urban areas

AO2 – Application of knowledge and understanding to analyse and evaluate strategies to improve environmental sustainability in contrasting urban areas

Level	Marks	Description
3	7–9	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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some



		relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

- Contemporary opportunities and challenges in developing more environmentally sustainable cities.
- Strategies for developing more environmentally sustainable cities.

- Evaluation of strategies to improve sustainability in contrasting urban areas, such as London, UK, a city in a HDE city and Mumbai, India, a city in an EME
- London:
 - Strategies to improve the environmental and social sustainability of local neighbourhoods.
 - BedZED was developed in the early 2000s in Hackbridge in London. City's first zero-carbon community. Construction of new buildings requires materials which are often transported from outside regions, increasing fuel use and emissions.
 - For BedZED, 52 per cent of construction materials were sourced within 35 miles. 15 per cent of the materials used were either reclaimed or recycled, reducing the need for new resources to be used.
 - The development aimed to improve its sustainable energy use by using a biomass boiler. Homes were designed to reduce energy loss, making them more efficient.
 - Car sharing was encouraged to cut down the use of fossil fuels and reduce emissions.
 - Water use was reduced through the installation of energy efficient toilets.
 - o Access to greenspace helped the physical and mental wellbeing of residents.
 - At a city-wide level, environmental sustainability through managing transport: Transport for London.
 - The introduction of the congestion charge, where drivers paid to enter London's central area, reduced traffic congestion and helped to improve air quality. London's Ultra Low Emission Zone (ULEZ) also aims to tackle gas and particle emissions.
 - Increasing the frequency of different modes of public transport encourages people to leave their cars at home.
 - Developing cycle lanes and access for pedestrians promotes health and well-being as well as reducing fuel use.
- Mumbai:
 - In Mumbai, environmental sustainability of the built environment has been tackled through large scale redevelopment and small-scale improvement initiatives to improve living conditions for residents.
 - E.g. Large-scale improvements to the built environment have taken long periods of time to take place, e.g. plans were made in 2009 to redevelop Bhendi Bazaar, home to more than 20 000 people to tackle overcrowded conditions with poor access to facilities including sanitation, with the first phases completed in 2020. Large scale redevelopment plans of the Dharavi Slum have been delayed.
 - \circ $\;$ Large developments take more time and require more investment.
 - Smaller scale projects are often more successful at a local scale as the community is engaged in decision making and directly benefit from the changes made.



- Local government and NGOs have been involved in managing environmental issues in Mumbai and improving sustainability.
- Sanitation has been improved through SPARC, an Indian NGO, which has built 300 community managed toilet blocks.
- Waste issues have been tackled through the 'Clean Up Mumbai' campaign by the Municipal Corporation of Greater Mumbai to remove litter and educate residents about the benefits of reducing waste.
- Improvements in traffic management have been made through installing 550 smart traffic signals installed to regulate vehicle flow. Investment has been made in electric buses and smartphone technology used through the Chalo app to make payments quicker and easier.
- Candidates should come to an overall conclusion that assesses strategies to improve sustainability in one urban area.
- **13** AO1 Knowledge and understanding of environmental and social problems in urban areas and how they are managed.

AO2 – Application of knowledge and understanding to analyse and evaluate the extent to which dealing with environmental issues is more challenging than tackling social problems when managing urban areas. AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1-5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- Environmental problems in contrasting urban areas: atmospheric pollution, water pollution and dereliction.
- Strategies to manage these environmental problems.
- Impact of urban areas on local and global environments. Ecological footprint of major urban areas.
- Dimensions of sustainability: natural, physical, social and economic.

- Environmental problems include sanitation, drainage, air pollution, litter.
- Social issues include health, education, poverty and community engagement.
- Management can be at a range of scales, timeframes and involve different organisations and decision makers.
- Arguments for environmental problems as more challenging:
 - Problems directly lead to decreased life expectancy, e.g. improved sanitation and drainage needed to reduce water borne diseases such a cholera.
 - This requires high levels of investment, government planning and takes time to build.
 - Air pollution: more difficult to identify sources and need laws to implement limits on pollutants, policies to reduce emissions and for these to be enforced.
 - Areas can be affected by climate change which is on a global scale and requires international cooperation which takes time and may not be effective.
 - However, communities can help tackle issues on a local scale such as litter reduction and waste recycling, so large scale investment not always needed.
- Arguments for social issues as more challenging:
 - Improving life chances and decreasing social inequality is complex and linked to different factors.



- Government investment in education and health needed to raise literacy and numeracy rates and to increase life expectancy.
- \circ Issues such as discrimination need behavioural changes in society which may take time.
- Social issues such as poverty are closely linked to economic factors so these need to be considered when solutions are put forward.
- Social issues can affect individual neighbourhoods in different ways, e.g. differing types of crime.
- Community engagement is important and different groups may have different views on the best solutions.
- **14** AO1 Knowledge and understanding of impact of economic characteristics, lifestyles and attitudes on waste generation and disposal.

AO2 – Application of knowledge and understanding to analyse and evaluate the extent the impact of economic characteristics, lifestyles and attitudes on waste generation and disposal. AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely
		integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- Urban physical waste generation: sources of waste industrial and commercial activity, personal consumption. Relation of waste components and waste streams to economic characteristics, lifestyles and attitudes.
- The environmental impacts of alternative approaches to waste disposal: unregulated, recycling, recovery, incineration, burial, submergence and trade.

- Waste generation (production) in urban areas can be linked to different factors including economic characteristics, lifestyles and attitudes.
- Waste disposal (including the 3Rs reduce, reuse, recycle) in urban areas can be linked to different factors including economic characteristics, lifestyles and attitudes.
- Economic characteristics, lifestyle and attitudes can have both positive and negative impacts on both the production of waste and the methods used to reduce, reuse and recycle (3Rs).
- People in more wealthy countries tend to produce more waste per capita as they have higher levels of consumption.
- People in more wealthy countries tend to buy more products (with more packaging), as well as a variety of products which are made from a range of materials.
- Wealthier communities may have a more 'single use' culture and may rely more on items which are disposable, or foods packaged in plastic to increase their shelf life.
- People in more wealthy countries tend to use these products for less time, e.g. clothing, meaning that more are needed over time.
- Growing 'middle-class' populations, particularly in EMEs, will add to the amount of waste produced.
- HDEs and EMEs have more industrial activity which produces a higher amount of hazardous waste, requiring money to dispose of or recycle without harming people or the environment.
- Rising urbanisation, linked to economic growth, in parts of Asia and Africa also increases the concentration of waste from households and industrial activities in urban areas.
- HDEs may have more money for research and investment in new technology, so are able to produce materials which are more biodegradable.



- HDEs have more money to implement effective recycling schemes.
- Attitudes of people, businesses, organisations and governments are highly important if the level of waste is to be reduced and the amount of recycling increased.
- Attitude of governments at both national and local authority level is important.
- Greater awareness of the negative effects of waste products on the environment. This can lead to people taking greater responsibility for changing their behaviour to reduce the amount of products used and to engage with recycling.
- Success of recycling depends on how willing people are to sort waste produced, so products that can be recycled get into the right system.
- People can be encouraged to dispose of hazardous household waste, e.g. lithium batteries, more responsibly. Increases in recycling can lead to less volume of waste in landfill sites.
- Governments can have policies and guidelines on disposal and recycling and provide funds to enable new, more environmentally friendly waste schemes to be put into place.
- Governments also invest in the infrastructure needed to manage waste disposal.

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Chapter 10

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–5 are point-marked. 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - Many disease vectors, e.g. mosquitos or parasitic worms, thrive in warm temperatures with abundant rainfall (1).
 - Heavy rainfall creates stagnant water, providing habitats and breeding grounds for vectors (1).
 - Areas of the world with a warm and wet climate, e.g. between the Tropics, will have a higher incidence of diseases spread by vectors (1), such as malaria and bilharzia (1).
 - Mosquitoes are a disease vector spreading diseases, such as malaria, dengue fever and Zika virus (1). Mosquitos thrive in specific climatic conditions (1) – warm temperatures and abundant rainfall (1). Heavy rainfall creates stagnant pools of water, which allows mosquitoes to lay their eggs (1).
 - Areas with a warm and wet climate, e.g. between the Tropics, will have a higher incidence of these diseases (1). Transmission of malaria peaks during and shortly after rainy seasons (1).

Example answer: There is a relationship between climate and incidence of disease. Mosquitoes are a disease vector that spread diseases such as malaria and bilharzia. They thrive in specific climatic conditions – warm temperatures and abundant rainfall. Heavy rainfall creates stagnant pools of water, which allows mosquitoes to lay their eggs. Areas of the world with a warm and wet climate, e.g. between the Tropics, will have a higher incidence of these diseases and transmission of malaria peaks during and shortly after rainy seasons.

2 AO1 = 4

- The pattern of food consumption varies globally and between regions (1).
- The quantity of food available for consumption has increased globally (1), but varies between region, with North America having the highest (1) and Africa having the lowest (1).
- The share of the population who are undernourished is highest in Sub-Saharan Africa (1). Rates in South Asia are higher than the Americas and East Asia (1).
- In 2020, 53 per cent of the population were undernourished in Somalia, whereas rates in North America and Europe are below 2.5 per cent (1).
- Rates of overconsumption are increasing due to an increased intake in food high in fat and sugar (1), particularly in lower- and middle-income countries (1).

3 AO1 = 4

- Top layers of soil are eroded by wind, intensive farming, deforestation, overcropping or prolonged and heavy rainfall (1).
- The rate of erosion is determined by climate, topography, soil type and vegetation cover (1).
- Soil quality is important to agricultural output and yield (1).
- Soil erosion could lead to a loss of the fertile layer of soil and lack of nutrients for crop growth (1).
- Land is less productive, so agricultural productivity is lower (1).



4 AO1 = 4

- A decline in fertility rates can lead to economic growth (1) due to the productivity of the working-age population and low number of young dependants (1).
- Money can be invested in social development and a country can see improvements (1).
- This time is limited, as a prolonged fall in fertility rates will lead to those who were economically active becoming elderly dependents alongside a shrinking workforce, which will reduce economic growth (1).

5 AO1 = 4

- Economic migrants weigh up push and pull factors (1) and assess intervening obstacles when deciding whether to migrate (1). There are many interlinked factors which affect migration flows (1).
- They are attracted by the opportunity to remit their wages to their family in the origin country (1).
- Elderly members of the population could engage in retirement migration, e.g. UK to Spain (1).
- Many migrants now engage in south-south migration (1), where economic migrants move to low- and middle-income countries (1) due to the increasingly restrictive nature of advanced economies' migration policies, also due to growing opportunities in rapidly developing industrialising countries and the ease of travelling shorter geographical distances (1).

Questions 6–13 are level-marked.

6 AO3 – Analysis of the trends, connections and relationships between access to drinking water and the number of deaths attributed to unsafe water.

AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support.
		 Clear connection(s) between different aspects of the data.
1	1–3	• Basic analysis of the quantitative evidence provided, which makes limited use of data in support.
		Basic connection(s) between different aspects of the data.

- There is a clear relationship between access to drinking water and deaths attributed to unsafe water.
- Almost 98 per cent of high-income countries have safely managed drinking water access.
- Only 29 per cent of low-income countries have safely managed water.
- Areas such as sub-Saharan Africa and Central and South Asia have higher numbers of deaths attributed to unsafe water, e.g. India has 50–100 per 100,000 deaths.
- There are anomalies, such as Latin America and the Caribbean having only 75 per cent of the population accessing safely managed drinking water, but South America shows only 0–10 per 100,000 deaths attributed to unsafe water.
- The key for Figure 1b is shown in ranges, so the choropleth map does not show which areas have zero deaths from unsafe water.

Example answer: There is a clear relationship between access to drinking water and deaths attributed to unsafe water. Almost 98 per cent of high-income countries have safely managed drinking water access. Areas such as North America and Europe have 0–10 per 100,000 deaths attributed to unsafe water. Only 29 per cent of low-income countries have safely managed water. Areas such as sub-Saharan Africa and Central and South



Asia (India, Pakistan, Bangladesh) have higher numbers of deaths attributed to unsafe water, e.g. India has 50-100 per 100,000 deaths. There may be some anomalies, such as Latin America and the Caribbean having only three-quarters of the population accessing safely managed drinking water, but South America shows only 0–10 per 100,000 deaths attributed to unsafe water. As the choropleth map key is shown in ranges, it is unclear which areas have zero deaths from unsafe water.

7 AO3 – Evaluation and analysis of the quantitative data shown in Figures 2a and 2b in showing the leading causes of death in low-income countries and high-income countries. AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of data in support.
		 Clear connection(s) between different aspects of the data.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of data in support.
		 Basic connection(s) between different aspects of the data.

- The graphs are useful in showing variation in the leading causes of death due to development levels.
- E.g. in low-income countries, 6 of the 10 leading causes of death are from communicable diseases.
- E.g. in high-income countries only 1 leading cause of death is from a communicable disease.
- E.g. in high-income countries 9 out of the 10 leading causes of death are from non-communicable diseases, whereas in low-income countries only 3 leading causes of death are from a non-communicable disease.
- The graphs show change between 2000 and 2019 clearly, they show that in low-income countries, the deaths from all communicable diseases have decreased between 2000 and 2019 and the deaths from all non-communicable diseases have increased.
- In high-income countries, deaths from all causes have increased, with the exception of stroke and heart disease, which have decreased.
- Some of the categories are a large group of diseases e.g. lower respiratory infections, so it is not clear which diseases are included. Some are singular diseases e.g. malaria.
- The data is in raw numbers, with two very different axes, which makes comparison more difficult. Percentage data would be easier to compare.
- **8** AO1 Knowledge and understanding of population change in a country/society. AO2 – Application of knowledge and understanding to evaluate the extent to which the implications of the population change are socio-economic.

Level	Marks	Description
3	7–9	 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. A well-balanced and coherent argument is presented.



2	4–6	 AO1 – Demonstrates some appropriate knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies some knowledge and understanding appropriately. Connections and relationships between different aspects of study are emerging/evident with some relevance. Analysis and evaluation evident and supported with some appropriate evidence. A clear but partial argument is presented.
1	1-3	 AO1 – Demonstrates basic/limited knowledge and understanding of concepts, processes, interactions and change. These offer 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. A basic argument is presented.

• Case study of a country/society experiencing specific patterns of overall population change – increase or decline – to illustrate and analyse the character, scale and patterns of change, relevant environmental and socio-economic factors and implications for the country/society.

AO2

- There are several implications of population change, which are socio-economic and environmental.
- For example, in China, there is an ageing population which increases the dependency ratio, from 37 per cent in 2010 to 45 per cent in 2021.
- There is a decline in economic growth due to a shrinking workforce it no longer has a large, cheap labour force to drive industrialisation and growth.
- There is a risk to social security as there is less money to put into pensions and healthcare.
- There is less environmental degradation due to a smaller population and a shift from the polluting industrial sector to cleaner technologies and service sector jobs.
- Evaluation of the extent to which the implications are socio-economic. Environmental implications should be considered as well.

Answers will vary according to the country/society studied. If no country or society is stated or inferred maximum level 1.

9 AO1 – Knowledge and understanding of the impact of environmental change on health.

AO2 – Application of knowledge and understanding to evaluate the extent to which there are increasing health concerns caused by environmental change.

Level	Marks	Description
3	7–9	 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. A well-balanced and coherent argument is presented.



2	4–6	 AO1 – Demonstrates some appropriate knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies some knowledge and understanding appropriately. Connections and relationships between different aspects of study are emerging/evident with some relevance. Analysis and evaluation evident and supported with some appropriate evidence. A clear but partial argument is presented.
1	1-3	 AO1 – Demonstrates basic/limited knowledge and understanding of concepts, processes, interactions and change. These offer 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. A basic argument is presented.

- Health impacts of global environmental change: ozone depletion skin cancer, cataracts; climate change thermal stress, emergent and changing distribution of vector-borne diseases, agricultural productivity, and nutritional standards.
- The relationship between environment variables, e.g. climate, topography (drainage) and incidence of disease. Air quality and health. Water quality and health.

AO2

- There are increasing health concerns caused by environmental change.
- The graph shows increasing rates of melanoma (skin cancer) in males and females between 1975 and 2020.
- Ozone depletion the thinning of the ozone layer, caused by human-produced chlorofluorocarbons (CFCs), increasing the amount of UV radiation that reaches Earth.
- Skin cancer UV radiation is a carcinogen that increases the risk of someone developing two types of skin cancer.
- Cataracts exposure to UVB radiation increases the risk of cortical cataracts developing in the eyes.
- Thermal stress rising temperatures may result in increased cases of heat stroke, exhaustion, cramps and rashes, which are greater in the elderly or those with comorbidities.
- **10** AO1 Knowledge and understanding of the role of international agencies and NGOs in promoting health and combating disease at the global scale.

AO2 – Application of knowledge and understanding to evaluate the role of international agencies and NGOs in promoting health and combating disease at the global scale.

Level	Marks	Description
3	7–9	 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. A well-balanced and coherent argument is presented.


2	4–6	 AO1 – Demonstrates some appropriate knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies some knowledge and understanding appropriately. Connections and relationships between different aspects of study are emerging/evident with some relevance. Analysis and evaluation evident and supported with some appropriate evidence. A clear but partial argument is presented.
1	1–3	 AO1 – Demonstrates basic/limited knowledge and understanding of concepts, processes, interactions and change. These offer 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. A basic argument is presented.

- Role of international agencies and NGOs in promoting health and combating disease at the global scale.
- Management and mitigation strategies of biologically transmitted disease and non-communicable disease. AO2
- There are a range of organisations involved in promoting global health and combating disease.
- The World Health Organization's goal is 'to promote health, keep the world safe, and serve the vulnerable' (WHO, 2018). They respond to global health emergencies, strengthen healthcare systems and research and monitor health situations. They are aiming to offer, by 2023, one billion more people universal health coverage, better protection from health emergencies and improved health and wellbeing.
- UNICEF is an agency of the UN responsible for children's humanitarian aid. For global health they provide vaccines, assist with risk factors for disease, e.g. sanitation, and provide emergency healthcare aid. It focuses on supporting local healthcare services to reduce deaths from childhood diseases and maternal mortality.
- Médecins Sans Frontières (MSF) is an NGO which provides emergency medical aid to countries suffering from conflict, natural hazards and epidemics. Doctors and healthcare staff provide medical care in conflict zones, vaccinations in outbreaks and medical assistance for refugees.
- For example, malaria the WHO's Global Malaria Programme coordinates the efforts to eliminate malaria, monitors national programmes, and sets the standards for malaria mitigation.
- Sustainable Development Goal 3.3 aims to end epidemics of malaria by 2030.
- The USA's President's Malaria Initiative aims to reduce malaria deaths by 50 per cent in 15 African countries through supporting indoor residual spraying, distributing mosquito nets, strengthening healthcare systems and educating for behaviour change.
- Cancer the WHO's Global action plan aims to promote national cancer plans and set standards for early diagnosis, treatment and monitoring.
- Evaluation of the role of international agencies and NGOs is important in promoting health as
 organisations like the WHO set the global standard for responses to health issues and respond to health
 emergencies.
- NGOs have an important role as they can work on the ground, with bottom-up, local approaches to meet the needs of smaller communities.
- Both types of organisations work at different scales to effectively promote health and combat disease.
- National governments are also very important in promoting health and combating disease as they have the responsibility and authority to make changes within their country and protect their citizens.



- Many organisations working together have the most effective role in promoting health and combating disease.
- **11** AO1 Knowledge and understanding of future population–environment relationship.

AO2 – Application of knowledge and understanding to evaluate the extent to which the future population– environment relationship can be predicted.

AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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. A well-balanced and coherent argument is presented.
2	4–6	 AO1 – Demonstrates some appropriate knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies some knowledge and understanding appropriately. Connections and relationships between different aspects of study are emerging/evident with some relevance. Analysis and evaluation evident and supported with some appropriate evidence. A clear but partial argument is presented.
1	1-3	 AO1 – Demonstrates basic/limited knowledge and understanding of concepts, processes, interactions and change. These offer 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. A basic argument is presented.

A01

- Prospects for the global population.
- Projected distributions.
- Critical appraisal of future population-environment relationships.

- There are different estimations for future population growth. In 2022, the UN estimated that the population will rise to over 10 billion by 2059. There are different scenarios to make projections for future growth based on different fertility and migration levels.
- Governmental policies to slow or increase population growth will affect population size, or encouraging or discouraging migration will affect population distribution.
- Global responses to climate change are uncertain, e.g. international agreements and carbon emission policies.
- There may be innovation and developments in agriculture and resource use (Boserup's view).
- The speed of economic and social development of low-income countries will vary, along with the associated impact on fertility rates.
- Societal values around resource consumption and habitat conservation may change.



- The future of population-environmental relationships is uncertain because they depend upon a number of factors which are difficult to predict.
- Past trends can be analysed, and a number of different futures can be predicted, which different degrees of certainty.

12 AO1 – Knowledge and understanding of environmental variables in determining incidence of disease.
 AO2 – Application of knowledge and understanding to assess the relative importance of environmental variables in determining incidence of disease.
 AO1 = 10, AO2 = 10.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 - 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. AO1 - 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.
2	6-10	 AO2 – 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. AO1 – 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

- Global patterns of health, mortality and morbidity. Economic and social development and the epidemiological transition.
- The relationship between environmental variables, e.g. climate, topography (drainage) and incidence of disease. Air quality and health. Water quality and health.
- The global prevalence, distribution, seasonal incidence of one specified biologically transmitted disease, e.g. malaria; its links to physical and socio-economic environments including impacts of environmental variables on transmission vectors.
- The global prevalence and distribution of one specified non-communicable disease, e.g. a specific type of cancer, coronary heart disease, asthma; its links to physical and socio-economic environment including impacts of lifestyles.

- Environmental variables (climatic factors and topographical factors) are important in determining incidence of disease.
- Many disease vectors, e.g. mosquitos or parasitic worms, thrive in specific climatic conditions warm temperatures and abundant rainfall. Mosquitoes are a disease vector that spread diseases such as malaria, dengue fever and Zika virus.
- Heavy rainfall creates stagnant pools of water, which provide habitats and breeding grounds for vectors.
- Areas of the world with a warm and wet climate, e.g. between the Tropics, will have a higher incidence of these diseases spread by vectors such as malaria and bilharzias. Transmission of malaria peaks during and shortly after rainy seasons.
- An increase in the average daily sunshine hours increases exposure to ultraviolet light and can cause skin cancer.
- A lack of sun exposure can lead to a deficiency in vitamin D and can cause rickets.
- Depletion of the ozone layer increases the amount of UV radiation reaching the Earth which can lead to an increased risk of skin cancer and cataracts.
- Topographical factors (the natural features of the land, e.g. drainage and relief) link with climatic factors.
- In areas of good drainage, stagnant pools are less likely to accumulate.
- At higher altitudes, temperatures drop, so don't provide a suitable habitat for disease vectors.
- Global patterns of health are affected by a number of different factors, such as the wealth of the country, the availability of high-quality healthcare, the climate and air and water quality.



- There are also economic variables/factors that determine the incidence of disease. In high income countries, deaths from communicable diseases, e.g. cholera are lower due to high quality healthcare.
- Increased life expectancies due to socio-economic development results in causes of death mainly from non-communicable diseases, e.g. cancer and dementia.
- Air pollution and water pollution are important risk factors in mortality and morbidity worldwide. Human activity can lead to pollutants in the air and water, which can lead to a decrease in air and water quality and an increased incidence of some diseases.
- The importance of environmental variables for incidence of disease will vary depending on the country being discussed, the type of disease (biologically transmitted or non-communicable), and the level of development of the country.
- It could be said that the level of development of the country is the most important factor as this underpins the ability of countries to deal with and combat any type of disease.

Example answer: Environmental variables, meaning climatic and topographical factors, are important in determining incidence of disease. Many disease vectors, such as mosquitos and parasitic worms, thrive in specific climatic conditions – warm temperatures and abundant rainfall. Mosquitoes are a disease vector that spread diseases such as malaria, dengue fever and Zika virus. Areas of the world with a warm and wet climate, such as between the Tropics, with many stagnant pools of water, provide ideal habitats and breeding grounds for vectors, which spread diseases such as malaria and bilharzias. Transmission of malaria peaks during and shortly after rainy seasons.

An increase in the average daily sunshine hours increases exposure to ultraviolet light and can cause skin cancer. Conversely, a lack of sun exposure can lead to a deficiency in vitamin D and can cause rickets. Depletion of the ozone layer increases the amount of UV radiation that reaches the Earth's surface, leading to an increased risk of skin cancer and cataracts.

Topographical factors (the natural features of the land, e.g. drainage and relief) link with climatic factors to determine the incidence of disease. In areas of good drainage, stagnant pools are less likely to accumulate, and at higher altitudes, temperatures drop, so don't provide a suitable habitat for disease vectors.

Global patterns of health are affected by a number of different factors, such as the wealth of the country, the availability of high-quality healthcare, the climate, and air and water quality.

There are also economic variables/factors that determine the incidence of disease. In high-income countries, deaths from communicable diseases are lower due to high quality healthcare. Increased life expectancies due to socio-economic development means that causes of death are mainly from non-communicable diseases, e.g. cancer and dementia.

Air pollution and water pollution are important risk factors in mortality and morbidity worldwide. Human activity can lead to pollutants in the air and water, which can lead to a decrease in air and water quality and an increased incidence of some diseases.

The importance of environmental variables for incidence of disease will vary depending on the country being discussed, the type of disease (biologically transmitted or non-communicable), and the level of development of the country. It could be said that the level of development of the country is the most important factor as this underpins the ability of countries to deal with and combat any type of disease.



13 AO1 – Knowledge and understanding of the implications of migration.

AO2 – Application of knowledge and understanding to assess the extent to which the implications of migration are mainly economic.

AO1 = 10 AO2= 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 AO2 – 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. AO1 – 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.
2	6–10 1–5	 AO2 - 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. AO1 - 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. AO2 - Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the
		 Dased 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.



- Agricultural systems and agricultural productivity. Relationship with key physical environmental variables climate and soils.
- Characteristics and distribution of two key zonal soils to exemplify relationship between soils and human activities especially agriculture. Soil problems and their management as they relate to agriculture: soil erosion, waterlogging, salinisation, structural deterioration.

AO2

- Agricultural productivity is affected by a number of physical and human factors.
- Physical factors include: temperature, precipitation and water supply, altitude, gradient, which affects soil characteristics and the use of machinery, aspect, soil depth and soil type water-retention capacity, structure, pH, leaching, and mineral content.
- Human factors include land ownership, farm size, transport to markets, government subsidies, and technology.
- Climate change is a key issue facing agriculture.
- Water-intensive crops, such as rice, sugar, cotton and wheat, may be impacted by unpredictable variations in precipitation that could threaten their cultivation.
- Warmer temperatures may increase the length of growing seasons, e.g. in the UK.
- Extreme weather events, such as heatwaves and drought, may lead to crop failure and heat stress in livestock.
- More intense storms may lead to crop destruction in areas that experience tropical cyclones.
- Current rainfall patterns are expected to change, and warmer climates may see diseases and pests in new areas.
- Soil problems includes soil erosion, waterlogging, salination and structural deterioration.
- Soil erosion Top layers of soil are eroded by wind, intensive farming, deforestation, overcropping or prolonged and heavy rainfall. The rate of erosion is determined by climate, topography, soil type and vegetation cover.
- Waterlogging Over-irrigation, heavy rainfall and low evaporation, where surplus water is not sufficiently drained away, can lead to waterlogged soil where roots suffer from a lack of oxygen.
- Salination Waterlogged soil can increase the water table and bring dissolved salts into the topsoil affecting the roots of salt-intolerant plants.
- Structural deterioration Compaction of soil particles leads to less drainage and waterlogging.

Credit any other valid approach. Evaluation should be based upon preceding content.

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Oxford Revise | AQA A Level Geography | Answers

Chapter 11

Exemplar answers have been written by the author of the revision guide and are not created or approved by AQA. They do not necessarily represent the only possible solution or way to answer the question. All exemplar answers are likely to be in the top mark band.

Questions 1–4 are point-marked. 1 mark per valid point with extra marks for development.

- **1** AO1 = 4
 - When it can be reasonably expected that the majority of resources could be upgraded to indicated mineral resources (1).
 - Continued exploration is usually a requirement for developing a possible resource. (1).
 - A possible resource is an upgrade from an inferred resource (1).
 - The status of possible resource shows that economic viability is a possibility (1).

Example answer: A possible resource is when it can be reasonably expected that the majority of resources could be upgraded to indicated mineral resources. Continued exploration is usually a requirement for developing a possible resource. A possible resource is an upgrade from an inferred resource (where quality and quantity can only be assessed through limited evidence indicated). The status of possible resource shows that economic viability is a possibility.

- **2** AO1 = 4
 - Primary sources of energy are forms of energy found in nature that have not been subjected to any human-engineered conversion process (1).
 - They are used in the form they are found or are converted to secondary sources (1).
 - Secondary sources of energy are derived from the transformation of primary sources (1).
 - The most common secondary source is electricity, which can be generated from the conversion of various primary sources like coal, natural gas, wind, or sunlight (1).
- **3** AO1 = 4
 - A stock resource is a non-renewable, finite, and therefore exhaustible resource (1).
 - Resource exploration is the initial stage in the resource development process, involving the search for stock resources (1).
 - Resource exploitation is the phase following the discovery of a resource where it is extracted for economic gain (1).
 - Resource peak is the phase of maximum production of a resource before depletion occurs (1).
- **4** AO1 = 4
 - Virtual water is the volume of fresh water used to produce a product (1), measured at the place where the product was actually made (1).
 - A trade in virtual water allows water-scarce regions to import products that require a lot of water to produce, so conserving water (1).
 - High demand for products requiring a lot of water to produce can cause severe water shortages in exporting regions (1).



Questions 5–13 are level-marked.

AO3 – Analysis of iron ore exploration budgets and price data to identify patterns and anomalies in the data, using data manipulation to support response.

AO3 = 6

Level	Marks	Description
2	4–6	 Clear analysis of the quantitative evidence provided, which makes appropriate use of data to support.
		 Clear connection(s) between different aspects of the data.
1	1–3	 Basic analysis of the quantitative evidence provided, which makes limited use of data to support.
		 Basic connection(s) between different aspects of the data.

- Figure 1a shows that exploration budget peaked in 2012 and fell to its lowest point in 2017, before fluctuating from 2018-2022.
- The range between the peak in 2012 and the low in 2017 was approximately \$2,400m.
- The number of companies involved in iron ore exploration also peaked in 2012. The change in the number of companies largely mirrored the change in exploration budget from 2011-2022. However, this is less the case from 2018-2022 with the number of companies rising from approximately 75 in 2018 to over 100 in 2021, but the exploration budget did not rise at the same rate.
- Figure 1b shows that from 2021 to 2022, the quantity of usable ore produced fell for seven of the twelve major iron ore producing countries shown.
- Similarly, for seven of those twelve countries, the iron content of the mine production decreased in the same period.
- The total amount of usable ore produced fell in 2022, with that year's production representing 97.6% of that produced in 2021. A reduction in usable ore was reflected in the production totals for five of the six largest producers shown in Figure 1b. India is the anomaly, as the only country showing an increase in usable ore produced in 2022.
- From 2021 to 2022, the fall in iron content of mine production was slightly larger than the fall in total usable ore produced, with 2022's production of iron content only representing 97.4% of what had been produced the year before.
- While the exploration budget increased from 2021 to 2022 (as shown in Figure 1a), production by the 12 major producers of iron ore (shown in Figure 1b) did not increase in the same period.
- Figure 1a provides a much more detailed insight into the changes in the iron ore production industry over time than Figure 1b, which only provides information about change between two consecutive years. Figure 1a allows observation of trends over an eleven-year period.

Example answer: Figure 1a shows that the iron ore exploration budget peaked in 2012 and fell to its lowest point in 2017, before fluctuating from 2018-2022. The exploration budget reached a high of \$2900 million in 2012 before falling to a low of \$500m in 2017. The number of companies involved in iron ore exploration also peaked in 2012, with just under 300 companies before falling to just under 60 companies in 2017. The change in the number of companies largely mirrored the change in exploration budget from 2011-2022. However, from 2018-2022 the number of companies increased from approximately 75 in 2018 to over 100 in 2021, but the exploration budget did not rise at the same rate. Figure 1b shows that for seven of the twelve major iron ore producing countries shown, from 2021 to 2022 the quantity of usable ore produced fell and the iron content of the mine production decreased.



The total amount of usable ore produced fell in 2022, with that year's production representing 97.6% of that produced in 2021. A reduction in usable ore was reflected in the production totals for five of the six largest producers shown in Figure 1b. India is the anomaly, as the only country showing an increase in usable ore produced in 2022. From 2021 to 2022, the fall in iron content of mine production was slightly larger than the fall in total usable ore produced, with 2022's production of iron content representing 97.4% of what had been produced in 2021. While the exploration budget increased from 2021 to 2022 (as shown in Figure 1a), production by the 12 major producers of iron ore (shown in Figure 1b) did not increase in the same period. Figure 1a provides a much more detailed insight into the changes in the iron ore production industry over time as it allows observation of trends over an eleven-year period. Figure 1b only provides information about change between two consecutive years.

6 AO1 – Knowledge and understanding of factors affecting water supply, strategies to increase water supply and sustainability issues.

AO2 - Application of knowledge and understanding to the novel situation, to evaluate the extent to which effective groundwater management requires high levels of economic development.AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

A01

- Sources of water; components of demand, water stress.
- Relationship of water supply (volume and quality) to key aspects of physical geography climate, geology, and drainage.
- Strategies to increase water supply to include catchment, diversion, storage and water transfers and desalination.
- Strategies to manage water consumption (including reducing demand).
- Sustainability issues associated with water management: virtual water trade, conservation, recycling, 'greywater' and groundwater management.



AO2

- The countries selected for Figures 2a and 2b are Arab states. It can be assumed that the climate means there are conditions of water scarcity due to low levels of precipitation and high rates of evaporation.
- Figure 2a shows that, in some states, groundwater withdrawal can be low where high rates of surface water withdrawal are possible (abstraction from rivers), e.g. in Morocco, Egypt, Somalia and Iraq. Figure 2b shows significant variation in economic development for these four countries Somalia has the lowest GDP per capita (\$447), but the second-lowest use of groundwater withdrawal.
- There is also variation among those countries with a high level of groundwater withdrawal Libya, Djibouti and Palestine have very high rates of more than 85 per cent groundwater withdrawal, and have low GDP per capita in 2021 of \$6357, \$3150, and \$5795 respectively. Saudi Arabia also has groundwater withdrawals of just under 90 per cent but GDP per capita of \$51,600, so it is not conclusive that economic development automatically brings effective groundwater management.
- Figure 2a shows the states that make extensive use of desalination and recycling of water. UAE, Kuwait, Bahrain, and Qatar also have high GDP per capita (\$78,255, \$67,891, \$52,129 and \$112,789 respectively) suggesting that high levels of economic development are required to afford these technologies. These four states also have no withdrawal from surface water sources, suggesting they have few natural alternatives to groundwater.
- A likely conclusion therefore is that where there are no natural alternatives to groundwater, the use of desalination and recycling water to effectively manage (i.e. reduce) a dependence on groundwater is an option restricted to states with high levels of economic development.

Example answer: The countries in Figures 2a and 2b are all Arab states. It can be assumed that the climate means there are conditions of water scarcity due to low levels of precipitation and high rates of evaporation. Figure 2a shows that, in some states, groundwater withdrawal can be low, where high rates of surface water withdrawal are possible (abstraction from rivers), such as in Morocco, Egypt, Somalia and Iraq. Figure 2b shows significant variation in economic development for these four countries – Somalia has the lowest GDP per capita (\$447), but the second-lowest use of groundwater withdrawal. There is also variation among those countries with a high level of groundwater withdrawal – Libya, Djibouti and Palestine have very high rates of more than 85 per cent groundwater withdrawal, and have low GDP per capita in 2021 of \$6357, \$3150, and \$5795 respectively. Saudi Arabia also has groundwater withdrawals of just under 90 per cent but GDP per capita of \$51,600, so it is not conclusive that economic development automatically brings effective groundwater management. Figure 2a shows the states that make extensive use of desalination and recycling of water. UAE, Kuwait, Bahrain, and Qatar also have high GDP per capita (\$78,255, \$67,891, \$52,129 and \$112,789 respectively) suggesting that high levels of economic development are required to afford these technologies. These four states also have no withdrawal from surface water sources, suggesting they have few natural alternatives to groundwater.

A likely conclusion therefore is that where there are no natural alternatives to groundwater, the use of desalination and recycling water to effectively manage (i.e. reduce) a dependence on groundwater is an option restricted to states with high levels of economic development.

AO1 – Knowledge and understanding of factors affecting energy supplies in a globalising world, including competing national interests; knowledge and understanding of strategies to manage energy consumption.
 AO2 – Application of knowledge and understanding to the novel situation, to assess the security of energy supplies in a globalising world.

AO1 = 4 AO2 = 5



Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

- Energy supplies in a globalising world: competing national interests and the role of transnational corporations in energy production, processing, and distribution.
- Strategies to increase energy supply (oil and gas exploration, nuclear power, and development of renewable sources).
- Strategies to manage energy consumption (including reducing demand).

- Figure 3a shows a reduction in gas dependence on Russian natural gas from 45 percent in 2021, to 24 per cent in 2022, and then 14 per cent in the first 6 months of 2023. This was in relation to Russia's invasion of Ukraine, with countries looking for more secure energy supplies and also to impose financial costs on Russia as sanctions.
- Figure 3a shows that the total consumption of natural gas in the EU did not decrease significantly between 2021 and 2022 (around 334 bcm), and that the reduction in supply from Russia was therefore made up by increasing supply from other countries. This was made possible by the connectivity of globalisation, which enable new supplies to be sourced and brought online.
- Figure 3a shows that the USA's share of the EU's natural gas supply has increased the most, from 6 per cent in 2021 to 15 per cent in 2022 and 18 per cent for the first six months of 2023. This supply was probably made by ship rather than by pipeline, given the distance from the USA to the EU.
- Norway, an important supplier before the invasion of Ukraine, has also seen its share grow significantly, from 24 per cent of the EU's natural gas supply to 27 per cent in 2022 and 30 per cent in the first six months of 2023. This suggests the value of dependable and politically aligned suppliers in an increasingly insecure world.
- Other regions have not increased their share of supplies significantly; for example, North Africa's share actually decreased from 13 per cent in 2021 to 12 per cent in 2022, and Qatar only increased by 1 per cent from 4 per cent to 5 per cent over the same period.



- Figure 4a shows the cost of reducing imports for the EU countries, with monthly prices increasing from around \$3 per million btu before the invasion to a high of around \$71 in October 2022 over 2200 per cent! At the same time, prices in the USA increased by around \$6 per million btu. So, while insecure energy supplies can be replaced, this comes at a heavy cost, regardless of globalisation.
- The EU's decision to reduce its dependence on Russian natural gas came at a significant cost. It was possible for EU countries to import the same overall amount of natural gas, but at the same time Russia remained the EU's third biggest supplier, after Norway and the USA. This suggests that pragmatism is also important: energy supplies must be maintained even if that means continued reliance on insecure suppliers.
- Strategies did not include any attempt to reduce natural gas consumption the amount imported remained the same. This is perhaps due to the short time period, but at the same time the environmental significance of a continued reliance on fossil fuels could be seen as a problematic strategy environmentally, when renewable sources also tend to be available in ways that increase rather than decrease security.
- 8 AO1 Knowledge and understanding of the relationship of water, energy or mineral ore use to key aspects of physical geography or to human factors.

AO2 - Application of knowledge and understanding to the novel situation, to assess the relative importance of physical and human factors in water, energy or mineral ore use, in relation to a case study area.AO1 = 4 AO2 = 5

Level	Marks	Description
3	7–9	 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.
2	4–6	 AO1 – Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy. AO2 – Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Evaluation is evident and supported with clear and appropriate evidence.
1	1–3	 AO1 – Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy. AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Evaluation is basic and supported with limited appropriate evidence.

A01

- Sources of water; components of demand, water stress.
- Relationship of water supply (volume and quality) to key aspects of physical geography climate, geology, and drainage.
- Strategies to increase water supply to include catchment, diversion, storage and water transfers and desalination.



- Strategies to manage water consumption (including reducing demand).
- Sources of energy, both primary and secondary. Components of demand and energy mixes in contrasting settings.
- Relationship of energy supply (volume and quality) to key aspects of physical geography climate, geology, and drainage.
- Strategies to increase energy supply (oil and gas exploration, nuclear power, and development of renewable sources).
- Strategies to manage energy consumption (including reducing demand).
- With reference to iron ore or a specified globally traded non-ferrous metal ore eg copper, tin, manganese.
- Sources of the specified ore. Distribution of reserves/resources. End uses of the ore. Components of demand for ore. Role of specified ore in global commerce and industry.
- Key aspects of physical geography associated with ore occurrence and working geological conditions and location.
- Case study of a specified place to illustrate and analyse how aspects of its physical environment affects the availability and cost of water or energy or mineral ore and the way in which water or energy or mineral ore is used.

- This answer is in relation to water use: a similar approach could be taken for energy use or mineral ore use. You should use your case study to illustrate and analyse how aspects of its physical environment affects the availability and cost of water or energy or mineral ore and the way in which water or energy or mineral ore is used.
- The volume and quality of water supply affects water use, and that supply is strongly related to key aspects of physical geography climate, geology, and drainage. Climate includes precipitation levels, evapotranspiration rates and seasonal variations; geology includes rock permeability and porosity, synclines and artesian basins and uplands and rain shadows; drainage includes river systems, drainage basin types and surface runoff.
- The geographical location and climate of an area play a crucial role in determining the availability of water resources. Arid regions or areas with seasonal rainfall patterns require different management strategies, such as water storage and conservation techniques, compared to areas with abundant rainfall.
- Strategies to increase water supply (human factors) include catchment management, diversion, storage, water transfer and desalination. An example of storage could be the Three Gorges Dam in China; of water transfer could be the South-North Water Transfer Project in China; of desalination could be the Sorek Desalination Plant in Israel.
- Strategies often depend on physical geography. For example, the Three Gorges Dam required river valleys across which dams could be built, underlying geology that was impermeable, and sufficient precipitation upstream to fill the reservoir. Desalination plants require sources of brackish or salt water, meaning coastal locations. Water transfer projects require a region with high precipitation and levels of evapotranspiration through the transfer regions which are not so high that all or almost all the water being transferred is lost. The choice of these large-scale strategies will almost always therefore depend on physical geography, as well as other factors such as cost.
- Strategies for managing water supply also include strategies to reduce consumption. In this case, physical geography is less important than human factors. The choice or determination of such strategies will be informed instead by ethics and politics, and possibly also economics, e.g. in terms of investment in new piping to reduce loss of water to leaks.
- Effective water management requires coordinated policies, regulations, and enforcement. Political commitment is essential for long-term investments in infrastructure and for enacting water conservation



measures – and strategies are usually very expensive, meaning that governments and private companies need to have the capacity to pay for them.

- Answers are likely to conclude that both physical and human factors are critically important in determining water management strategies, and their relative importance can vary greatly depending on the specific context and challenges faced.
- **9** AO1 Knowledge and understanding of strategies to increase energy supply and strategies to manage energy consumption at a global scale.

AO2 – Application of knowledge and understanding to an assessment of the success of attempts to achieve energy security by increasing energy supply compared to the success of attempts to manage energy consumption.

AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate.
3	11–15	 where appropriate. AO2 – 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. AO1 – 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.

- Sources of energy, both primary and secondary. Components of demand and energy mixes in contrasting settings.
- Strategies to increase energy supply (oil and gas exploration, nuclear power, and development of renewable sources).
- Strategies to manage energy consumption (including reducing demand).
- Sustainability issues associated with energy production, trade, and consumption: acid rain, the enhanced greenhouse effect, nuclear waste and energy conservation.

- Fossil fuels still predominate: the majority (80 per cent) of global energy production is still dominated by stock energy resources such as coal, oil, and natural gas. The USA, Saudi Arabia and Russia remain key producers of crude oil. This suggests that achieving energy security ensuring that energy is always available at an affordable price through renewables has not yet been achieved.
- There is however a growing shift towards flow resources such as solar, wind, hydroelectric and geothermal power. Globally, renewable energy made up 75 per cent of new energy capacity added in 2019. Renewables are also the fastest-growing energy sector, driven by both environmental concerns and technological advancements. China leads in total renewable energy production, while European countries like Ireland, Germany, UK, and Spain excel in wind power. This suggests that renewables are becoming a key part of the energy mix in many countries.
- Energy consumption has risen every year since the start of the century (with the exception of 2008 (financial crisis) and 2020–21 (COVID-19). The question can be easily answered in that respect: strategies to manage (i.e. reduce) energy consumption show no sign of proving effective. The challenge of achieving energy security increases each year therefore, regardless of if met by stock or flow resources.
- The key challenge for increasing energy supply from increased exploitation of fossil fuels is the climate crisis and global scientific consensus, together with a wide political consensus, that emissions from the



combustion of fossil fuels must be reduced, with countries globally signed up to emissions reduction targets.

- One challenge for renewables, however, is that flow resources cannot be physically transported, unlike stock resources. That means that stock resources can be imported to help meet a country's energy needs. That reduces the capacity for renewables to contribute globally to energy security. A country needs to generate enough of its own renewable energy, so it does not have to rely on imports of non-renewable energy to help it manage spikes in demand.
- Another challenge is the quality of energy supply from renewables: climate is a major factor (clear skies are better for solar power than cloudy skies, wind power is affected by seasonal changes in wind); inconsistency or intermittency in supply will limit the opportunity to achieve the key aim of energy security: ensuring energy is always available at an affordable price.
- The drive towards increasing the share of renewables in a country's energy mix is a feature more of developed economies than developing economies, which tend to rely heavily on one type of energy source, often fossil fuels, due to their availability and lower initial costs.
- In developed economies, the move towards renewables is hampered by the existing infrastructure for energy production and transmission, which does not affect developing economies to the same extent, enabling some of them to 'leapfrog' to renewables.

Example answer: Energy consumption has risen every year since the start of the century (with the exception of 2008 (financial crisis) and 2020–21 (COVID-19). The question can be easily answered in that respect: strategies to manage (i.e. reduce) energy consumption show no sign of proving effective, while energy production is continuing to meet demand and is doing so without increasing costs (unless because of shocks outside the energy industry. Energy supply is continuing to be effective because fossil fuels still dominate energy production globally – 80 per cent of global energy production is still dominated by stock energy resources such as coal, oil and natural gas. The USA, Saudi Arabia and Russia remain key producers of crude oil, suggesting that strategies to increase energy supplies are being achieved without this success coming from following a sustainable route.

There is however a growing shift towards flow resources such as solar, wind, hydroelectric and geothermal power. Globally, renewable energy made up 75 per cent of new energy capacity added in 2019. Renewables are also the fastest-growing energy sector, driven by both environmental concerns and technological advancements. China leads in total renewable energy production, while European countries like Ireland, Germany, UK, and Spain excel in wind power. This suggests that renewables are becoming a key part of the energy mix in many countries. Renewables are therefore part of the strategy of increasing energy supply, although the challenges of renewables remain.

For example, flow resources (renewables) cannot be physically transported, so when countries have a gap in supply, they turn to stock resources, which can be imported to help meet a country's energy needs. For a country to generate its own renewable energy and not rely on imports of non-renewable energy to help it manage spikes in demand (such as a cold winter), energy consumption would need to be significantly reduced.

Another challenge is the quality of energy supply from renewables. Climate is a major factor (clear skies are better for solar power than cloudy skies; wind power is affected by seasonal changes in wind). Inconsistency or intermittency in supply will limit the opportunity to ensure energy is always available at an affordable price, and while moves are not made to reduce energy consumption dramatically, this will always made reliance on renewables a challenge.



The drive towards increasing the share of renewables in a country's energy mix is a feature more of developed economies than developing economies; the latter tend to rely heavily on one type of energy source, often fossil fuels, due to their availability and lower initial costs.

In developed economies, the move towards renewables is somewhat hampered by the existing infrastructure for energy production and transmission. This is an obstacle developing economies do not face to the same degree, enabling some of them to 'leapfrog' to renewables.

In conclusion, consumption is showing no signs of being managed effectively, meaning that the success of strategies to increase energy supplies does not include a sufficient amount of success in achieving sustainable increased. While renewables are becoming an important part of the energy mix in some countries, especially those where physical geography gives key advantages (e.g. deserts for solar power, such as China's Tengger Desert Solar Park), renewables currently remain a small share overall in global energy supply, and most countries remain reliant on fossil fuels for ensuring sufficient energy to meet consumption demands is always available at an affordable price.

10 AO1 – Knowledge and understanding of the geopolitics of ore mineral distributions, trade and management.
 AO2 – Application of knowledge and understanding to an assessment of the extent to which the geopolitics of mineral ore are determined by advances in technology linked to globalisation.
 AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated
3	11–15	 where appropriate. AO2 - 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. AO1 - 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.



2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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 to the application of knowledge and understanding in different contexts. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	Nothing worthy of credit.
-	-	

- The geopolitics of energy, ore mineral and water resource distributions, trade, and management.
- With reference to iron ore or a specified globally traded non-ferrous metal ore, e.g. copper, tin, manganese.
 - Sources of the specified ore. Distribution of reserves/resources. End uses of the ore. Components of demand for ore. Role of specified ore in global commerce and industry.
 - Key aspects of physical geography associated with ore occurrence and working geological conditions and location.
 - Environmental impacts of a major mineral resource extraction scheme and associated distribution networks.
 - \circ $\;$ Sustainability issues associated with ore extraction, trade, and processing.

- Consumption of ore minerals often takes place in countries without access to their own deposits of the ore minerals, especially in advanced economies with smaller territories, for example in the EU and East Asia. This is the key factor determining geopolitical issues as trade in the ore minerals has to be negotiated.
- Economics are also a key determining factor, since fluctuations in global markets, driven by supply and demand, can significantly affect the geopolitics of ore minerals because prices heavily influence investment in exploration and development and the profitability of mining companies.



- Regardless of technology, political factors may mean that countries with rich ore mineral reserves may look to control access and distribution for strategic advantages (resource nationalism), or form trading blocs that reduce costs for allies.
- There are also environmental concerns about ore mineral extraction and processing that sometimes impact geopolitics, regardless of technology for example geopolitical tensions over resource development in the Arctic region.
- Technological advances can also impact on environmental factors in geopolitics, by reducing the impact of extracting and processing, for example, and by achieving reductions in the demand for ore minerals through improved recycling and ore mineral substitution.
- To what extent these technologies are linked to globalisation can be argued in a number of ways. The most compelling case is the link to the transnational corporations that dominate mineral ore industries. The companies invest heavily in research and development of technology that increase the profitability of resource extraction, processing, and shipping.
- Answers are likely to conclude, therefore, that although other factors than technological advances determine the geopolitics of mineral ore, technological advances linked to globalisation are a key component of these determining factors.
- 11 AO1 Knowledge and understanding of endogenous and exogenous factors (Changing places); knowledge and understanding of a specified place to illustrate and analyse how aspects of its physical environment affects the availability and cost of water or energy or mineral ore and the way in which water or energy or mineral ore is used.

AO2 - Application of knowledge and understanding to evaluate the influence of exogenous and endogenous factors on its resource security with regard to water or energy or a mineral ore.AO1 = 10 AO2 = 10

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated where appropriate
3	11–15	 AO2 - 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. AO1 - 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
		• A01 Concepts and processes.
		• AO1 – Generally clear awareness of scale and temporal change which is
2	6.40	integrated where appropriate.
2	6-10	AO2 – 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.
		 AO1 – 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.
1	1–5	AO2 – 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.
		 AO1 – Very limited relevant knowledge and understanding of place(s) and
		environments.
		 AO1 – Isolated knowledge and understanding of key concents, processes and
		interactions and change
		 A01 – Very limited awareness of scale and temporal change which is rarely
		integrated where appropriate. There may be a number of inaccuracies
0	0	Nothing worthy of credit
0	0	 Nothing worthy of credit.

• Case study of a specified place to illustrate and analyse how aspects of its physical environment affects the availability and cost of water or energy or mineral ore and the way in which water or energy or mineral ore is used. Factors contributing to the character of places: Endogenous: location, topography, physical geography, land use, built environment and infrastructure, demographic and economic characteristics; Exogenous: relationships with other places.

- Resource security is about the ability to ensure resources are available and accessible to people.
- Endogenous factors (changing places topic) are location, topography, physical geography, land use, built environment and infrastructure, demographic and economic characteristics.
- Exogenous factors are about relationships with other places.
- In relation to a case study such as water management in Mexico City, endogenous factors are extremely influential. In demographic terms, Mexico City has a large population of 21 million people, who rely on groundwater from aquifers for water supply. These aquifers are being depleted faster than they can be



replenished. The built environment is also an endogenous factor: impermeable surfaces do not allow rainfall (which is mostly in the May-October rainy season) to infiltrate and recharge the aquifers; instead, most of the rainwater mixes with sewage in the city's drainage system (built environment) and becomes unusable. The city's ageing infrastructure (built environment) also means that 40% of water is lost to leaks. Resource security is lowest in low-income neighbourhoods – economic characteristics and inequality being another endogenous factor.

- In terms of exogenous factors, such as migration or flows of investment, the most influential is likely to be climate change. In the case of Mexico City, climate change is making rainfall more unpredictable, reducing resource security.
- 12 AO1 Knowledge and understanding of a case study including attempts to manage the resource (either water or energy or mineral ore); knowledge and understanding of sustainability issues associated with water management, energy production, trade and consumption or ore extraction, trade and processing.
 AO2 Application of knowledge and understanding to an evaluation of whether economic demand for resources will always be the most significant factor in how sustainably their production, distribution and consumption is managed.

AO1 = 4 AO2 = 5

Level	Marks	Description
4	16–20	 AO2 – 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. AO1 – Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout. AO1 – Full and accurate knowledge and understanding of key concepts and processes throughout. AO1 – Detailed awareness of scale and temporal change which is well integrated
3	11-15	 where appropriate. AO2 - 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. AO1 - 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.
2	6–10	 AO2 – 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. AO1 – 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.
1	1–5	 AO2 – 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. AO1 – Very limited relevant knowledge and understanding of place(s) and environments. AO1 – Isolated knowledge and understanding of key concepts, processes and interactions and change. AO1 – Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies.
0	0	 Nothing worthy of credit.

- Case study of either water or energy or mineral ore resource issues in a global or specified regional setting to illustrate and analyse themes including the relationship between resource security and human welfare and attempts to manage the resource.
- Sustainability issues associated with water management: virtual water trade, conservation, recycling, 'greywater' and groundwater management.
- Sustainability issues associated with energy production, trade, and consumption: acid rain, the enhanced greenhouse effect, nuclear waste and energy conservation.
- Sustainability issues associated with ore extraction, trade, and processing.
- Alternative energy, water and mineral ore futures and their relationship with a range of technological, economic, environmental, and political developments.
- Sustainable resource development. Environmental Impact Assessment (EIA) in relation to resource development projects.

- Answers can be made in relation to a water, energy, or mineral ore resource. This answer is in relation to an energy resource. The question does not require a case study, but one has been used here as the topic of human welfare appears in the specification in a case study context.
- Before 2022, Slovakia was nearly 100 per cent reliant on Russian imports for natural gas, oil and nuclear fuel. The invasion of Ukraine by Russia in February 2022 led to Slovakia, as an EU member state, seeking ways to reduce its dependence on Russia, as part of the EU's sanctions in protest at the Russian invasion. This dependence could no longer be seen as sustainable given Russia's ability to use gas and oil prices as



leverage politically and given the contribution of its energy industry to Russia's investment in military capability.

- Slovakia had different options for reducing dependence on Russia: increase production, distribution and consumption of energy produced by burning coal, which is an energy source Slovakia does have; increase production of renewable energy; reduce consumption of energy overall; replace Russian supplies of oil, natural gas, and nuclear fuel by importing from other countries.
- Slovakia did not choose to return to coal as an energy source; politically the decision had already been
 made to phase out coal mining because Slovakia's brown coal is highly polluting and produces significant
 carbon emissions when burned. The EU is providing funds to help Slovakia's coal mining region, Upper
 Nitra, to transition to a post-coal economy and its two remaining coal-fired power stations are being
 converted to run on biomass fuel. This could be considered as both protecting human welfare (brown coal
 is highly polluting, coal mining is dangerous) and as an associated sustainability issue (carbon emissions
 from brown coal are not sustainable).
- Despite high demand for energy, Slovakia did not return to coal but is looking instead to transition to more sustainable energy sources, despite already having the coal reserves, the infrastructure for coal extraction and coal-fired energy production already integrated into the energy grid – so a cheaper option. This suggests sustainability issues were considered more important than human welfare, since affordability of energy supply is a welfare issue (consider older people unable to afford winter heating, for example).
- Slovakia has made moves to increase production of renewable energy, but this is so far limited the country only has five wind turbines. Investments are being made in energy production from biomass: coal-fired power stations can be converted relatively easily to burn biomass, making it a relatively cheap option. Since most heating is from central municipal resources rather than individual boilers in people's homes, there is a lot of potential for a switch to renewables for heating, which had been 90 per cent reliant on gas. This could be argued both ways: a less sustainable option than wind power, biomass, is chosen because it provides for human welfare needs (a solution that is quick and easy to integrate into current heating systems: low risk of people being left without heating, a solution that continues affordable / cheap energy supplies); a more sustainable option than continuing to rely on Russian oil or brown coal (which would meet human welfare needs of continuity and cheapness the best).
- This therefore provides limited support for the statement: Slovakia's limited move to renewables has followed the cheapest route: biomass.
- Significant support for the statement comes from Slovakia's continued dependence on Russian energy imports now reduced to 60 per cent for gas, while oil imports have been reduced less. The reasons for this are economic (human welfare because cheapest).
- The costs of adapting Slovakian refineries to different types of oil, and building infrastructure for new gas pipelines, certifying new suppliers of nuclear fuel and the economic risk of cutting off supplies before replacements were available, are very high. Economic demands for energy from Slovakia's industries and residences are very high, and consequently the government could not risk changing to a more sustainable energy supply too quickly or on too large a scale.
- On the other hand, the EU's decision to sanction Russia by reducing its imports of energy from Russia produced a sharp spike in energy prices globally. As a country that is reliant on energy imports, Slovakia was hit hard by these price increases, which led in turn to inflation and a severe cost of living crisis (a poor outcome in human welfare terms). One consequence has been political: elections in 2023 saw a coalition government elected with a pro-Russian leader (human welfare needs beating sustainability). The chances of Slovakia reducing its dependence further on Russian energy imports therefore looks less likely than before October 2023, and the reasons for this are primarily because human welfare needs are being met as a priority over tackling sustainability issues.

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