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
    - 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.

7 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.

AO1

- 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.

AO2

- 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.

AO1

- 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.

AO2

- 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.
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AO1

- 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 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.
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AO1

- 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 seif dunes, but answers are likely to recognise barchan-like shapes among the lines of seif 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. • 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.

AO1

- 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.
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.

AO1

- 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.

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 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.
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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.

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0	0	• Nothing worthy of credit.

AO1

- 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.

AO2

- 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
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0	0	• Nothing worthy of credit.

AO1

- 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.
AO1 = 10 AO2 = 10

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AO1

- 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.

AO2

- 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.
AO1 = 10 AO2 = 10

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AO1

- 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.

AO2

- 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.
AO1 = 10 AO2 = 10

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AO1

- 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.

AO2

- 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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