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.

5 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.

AO1

- 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.

7 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.

AO1

- 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).

AO2

- 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.

AO1

- 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.

AO2

- 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	• 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.

AO1

- 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.

AO2

- 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 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.

AO1

- 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.
    - Sustainability issues associated with ore extraction, trade, and processing.

AO2

- 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. • 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.

AO1

- 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.

AO2

- 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 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.

AO1

- 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.

AO2

- 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.