Exam Papers Practice

4.2 Access to Fresh Water

Mark Schemes

Course	SL IB Environmental Systems & Societies (ESS)
Section	4. Water & Aquatic Food Production Systems & Societies
Topic	4.2 Access to Fresh Water
Difficulty	Medium

To be used by all students preparing for
SL IB Environmental Systems & Societies (ESS)
Students of other boards may also find this useful

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Indicative Content
Desalination can be evaluated as follows: *Advantages:* Any **two** from the following: • Sustainability is achievable when energy demands are met by solar power / photovoltaic cells; [1 mark] • Seawater is more abundant compared to freshwater, offering a readily available source; [1 mark] • (Has the potential to) provide a consistent source of freshwater regardless of weather conditions; [1 mark] • Produces accessible/safe water for drinking/irrigation; [1 mark] • Byproducts e.g. salt can be repurposed to create valuable chemical products e.g. sodium hydroxide / hydrochloric acid; [1 mark] • Helps reduce stress on freshwater reserves that require conservation **OR** reduces pressure on overexploited freshwater sources, particularly in arid regions **OR** can be used to improve water security in areas prone to drought; [1 mark] *Disadvantages:* Any **two** from the following: • Demands substantial energy inputs / potentially contributes to increased global carbon emissions if reliant on fossil fuels; [1 mark] • Unsuitable for landlocked countries lacking access to seawater; [1 mark] • Construction of desalination facilities can lead to environmental damage/destruction/harm/pollution; [1 mark] • Disposal of the salt/brine generated has environmental risks / can pollute oceans **OR** saline discharge from desalination plants can harm marine ecosystems; [1 mark] • The salt is unsuitable for consumption; [1 mark] • High (initial) construction/operational/maintenance costs may mean it is not economically unviable; [1 mark]

2a

Indicative Content	Commentary
The availability of freshwater resources is being impacted by climate change in the following ways: Any **two** from the following: • Higher temperatures / increased evaporation are resulting in greater soil water loss, leading to aridity/desertification; [1 mark] • Higher temperatures / increased evaporation are leading to the depletion / salinisation of water supplies in lakes / other sources; [1 mark] • Changes in precipitation patterns e.g. due to increased occurrences of El Niño events, are triggering fluctuations in water supply, including both increases and decreases of supply/droughts; [1 mark] • Extreme precipitation events are leading to localised flooding but not necessarily increased freshwater availability; [1 mark] • Rising sea levels are causing groundwater / coastal aquifers to become inundated / saline due to saltwater intrusion / salinisation of groundwater; [1 mark]	In order to gain marks here, each statement must explicitly highlight a **specific aspect** of climate change (such as elevated temperatures or increased rates of evaporation) and also clearly describe its **impact** on **freshwater resources** (such as reduced stream discharge or increased soil aridity)

• Warmer temperatures are causing the melting of glaciers / ice caps, affecting water availability by increasing inputs to lakes / runoff into oceans **OR** melting glaciers can initially lead to increased river flow and water availability, but this might be followed by reduced flow as glaciers recede; [1 mark]	

2b

Indicative Content	Commentary
Other water management strategies that can reduce water scarcity include: Any **two** from the following: • Implementing of water-saving agricultural techniques like drip irrigation / terracing; [1 mark] • Establishing aqueducts / pipelines to transfer water from water-rich to water-scarce regions **OR** establishing water-sharing agreements among neighbouring regions to ensure equitable distribution; [1 mark] • Raising awareness through education / campaigns / increased charges to encourage water conservation/saving (behaviours) **OR** implementing water pricing mechanisms that reflect the true value of water resources to encourage conservation; [1 mark]	You would only gain marks for valid **management strategies** Personal choices / behaviours, such as taking short showers or turning taps off, would **not** be considered to be management strategies and therefore would not gain a mark here

• Reducing the cultivation of water-intensive crops such as meat/dairy/almonds/cotton **OR** encouraging the use of native / drought-resistant crop species to reduce irrigation needs; [1 mark] • Utilising technologies such as dams / grey-water recycling to gather / reuse water **OR** implementing water-efficient technologies in industries to reduce water consumption; [1 mark] • Adopting water-sensitive urban design practices / sustainable drainage systems / SuDS to reduce runoff and enhance groundwater recharge; [1 mark] • Undertaking efforts to cleanse/restore polluted freshwater bodies / lakes / aquifers; [1 mark]	

3a

Indicative Content	Commentary
i) The percentage of water projected to be used for agriculture in 2040 can be calculated as follows: • 1 750 + 750 + 125 + 500 = 3 125; [1 mark] • (1 750 ÷ 3 125) × 100 = <u>56%</u>; [1 mark] *ii) Reasons for the projected decrease in the demand for water in agriculture between 2023 and 2040 could include:*	In order to calculate the percentage, you first need to calculate the total projected demand for 2040 by adding up the water demands for each individual sector You can then divide the projected water demand for agriculture by the total projected demand (across all sectors) and multiply this result by 100 to get the percentage

Any **two** from the following: • Advancements/improvements in irrigation methods/technologies that increase/enhance water efficiency; [1 mark] • Increases in the use of crop strains that require less water / are resilient to drought; [1 mark] • Changing societal preferences away from meat consumption / water-intensive crops; [1 mark] • Implementation of precision agriculture techniques that optimise water application based on plant needs; [1 mark] • Adoption of agroforestry practices that create more water-efficient microclimates for crops; [1 mark] • Shift towards using treated wastewater for irrigation, reducing reliance on freshwater sources; [1 mark] • Government policies incentivising water-efficient practices and technologies in agriculture; [1 mark]	You would still gain 2 marks for the correct final answer in the absence of any working

3b

Indicative Content	Commentary
i) The overall trend in total global water demand between 2023 and 2055 is:	You would not gain marks for outlining factors or reasons that specifically refer to **energy-**

• Total global water demand will / is projected to increase; [1 mark] *ii) Factors contributing to this projected change include:* Any **three** from the following: • Growing global population leads to increased need/demand/requirement for drinking water / food production; [1 mark] • Increased consumption of meat / water-intensive foods results in greater irrigation need/demand/requirement; [1 mark] • Increasing (rates of) urbanisation typically leads to greater water usage for activities like street cleaning / park irrigation / golf courses / maintaining (urban) green spaces; [1 mark] • Drier climatic conditions due to climate change result in increased water need/demand/requirement for irrigation/lawns/drinking; [1 mark] • Improving living standards raise individual water usage for activities such as bathing / washing machines / private lawn irrigation; [1 mark] • Expansion of industries and manufacturing sectors requiring significant water inputs OR adoption of water-based	**related water usage**, as the projected water demand for this sector remains **constant** in the data For example, "a shift towards water-intensive renewable energy sources like hydropower or bioenergy" would not gain a mark here You would only gain marks for factors or reasons that, even indirectly, relate to higher **industrial**, **domestic** or **agricultural** water consumption

cooling systems in power plants and industries; [1 mark] • Increased water use in tourism and recreation activities, especially in water-scarce regions; [1 mark] • Development and expansion of water-dependent technologies such as urban hydroponics / vertical farming; [1 mark]	

4a

Indicative Content
Conflicts over fresh water are becoming an increasingly frequent due to: Any **three** from the following: • The increasing global population, which leads to decreased availability of fresh water for sharing / (equitable) distribution; [1 mark] • The greater fresh water demands created by development/urbanisation; [1 mark] • The unsustainable extraction of water from aquifers / groundwater storages / fossil resources; [1 mark] • Climate change-induced global warming contributing to drier/arid conditions in certain regions; [1 mark] • Pollution of freshwater sources reducing the usable fresh water supply **OR** environmental degradation reducing the quality and availability of freshwater sources; [1 mark] • International rivers crossing multiple countries, which leads to disputes over shared water resources **OR** transboundary water management disagreements between neighbouring countries; [1 mark] • Uneven / disparities in water distribution result in some regions facing inadequate water availability **OR** political instability / governance issues affecting equitable water distribution **OR**

economic/social disparities contributing to unequal access to water resources; [1 mark]

- Controlling water sources could translate to power over agriculture / food resources / associated profits; [1 mark]
- Competition between urban and agricultural water needs leading to tension; [1 mark]
- Increased demand for water-intensive industries exacerbating scarcity; [1 mark]
- Migration / displacement (of human populations) due to water scarcity straining resources in host regions; [1 mark]
- Limited investment in water infrastructure exacerbating/increasing fresh water scarcity in certain regions; [1 mark]

4b

Indicative Content	Commentary
Regarding dams, technocentric and ecocentric viewpoints would differ in the following ways: *Technocentric viewpoints* ***in favour of*** *dams:* Any **two** from the following: • Sees dams as advanced water collecting/storage technology; [1 mark] • Recognises their extensive capacity / the potential of dams to supply multiple regions; [1 mark] • Views the resulting reservoir as valuable for various activities (e.g. recreation); [1 mark] • Emphasises dams as tools for hydroelectric power generation, enhancing energy security; [1	The technocentric approach places a strong emphasis on the role of technology and human innovation in addressing environmental challenges and sustainability issues The ecocentric approach, also known as ecocentrism or deep ecology, is a philosophical and ethical perspective that places intrinsic value on the entire natural world, emphasizing the interconnectedness and interdependence of all living and non-living elements in ecosystems

mark] • Appreciates the role of dams in flood control / mitigating water-related disasters; [1 mark] • Regards large-scale water storage from dams as vital for agricultural irrigation / food security; [1 mark] *Ecocentric viewpoints **against** dams:* Any **two** from the following: • Prefers smaller/localised water storage solutions over larger dams; [1 mark] • Emphasises water conservation / reduced usage to reduce the need for / reliance on dams; [1 mark] • Recognises that dams (potentially) disrupt downstream environments / reduce flow (downstream); [1 mark] • Expresses concern about the ecological impacts of dam construction e.g. habitat destruction; [1 mark] • Advocates for natural flow patterns in rivers, considering them crucial for ecosystems; [1 mark] • Prioritises preserving biodiversity / aquatic life over dam-related benefits; [1 mark]	