

(b) (i) Explain how irrigation can lead to salinization. [2]

(b) Outline one environmental problem caused by eutrophication. [2]

(c) Examine the environmental impacts of agriculture on water quality. [10]

(b) Define the concept of "maximum sustainable yield" of freshwater. [2]

(c) Explain one human reason and one physical reason why some areas of a freshwater lake such as this experience high levels of eutrophication. [3+3]

a) (i) Briefly outline how the natural recharge of an aquifer takes place. [2]

(ii) Explain two consequences of salinization for farmers. [2+2]

Define the term groundwater. [1]

Salinization is the build-up of salts in soil to an excessive level. It can occur when there is over-irrigation [1] (ie, where more water is added than can be taken up by the plants). If the groundwater has a high salt content and the water table rises, the soil in fields may have salt levels that are too high for plant growth [1]. For example: As water passes over/through the soil, it dissolves various minerals and nutrients [1] / in some areas, naturally high levels of evaporation increase the salt content at the surface [1] / capillary action also brings water to the surface where evaporation leaves the salts [1].

Award [1] for the problem and [1] for development. For example: Fish die [1] due to oxygen depletion [1], Possible problems include: • declining biodiversity • creation of dead zones • excessive vegetation on surface

Responses should show an understanding of any of the following: salinization, agro-chemical runoff, groundwater pollution, eutrophication of watercourses. Credit other valid positive impacts. As agriculture becomes more intensive, there are greater inputs of chemical fertilizer and irrigation and greater outputs of waste, eg manure and chemical fertilizer. These can lead to a variety of types of environmental impacts in different areas. Good answers may include a structured discussion of the relative importance of a variety of agricultural impacts on water quality. An alternative approach would be to question who or what (land, incomes, ecosystems, local businesses) is impacted, and recognize that some parts of the world may be more seriously affected than others.

The maximum level of extraction of water [1] that can be maintained indefinitely for a given area [1]. Alternative acceptable definitions include: • the relationship/balance between inputs and outputs [1] so that water does not run out for the foreseeable future/on an annual basis [1] • the largest amount of water that can be taken from a resource [1] without depleting the original source or potential for replenishment [1].

In each case, award [1] for the reason and up to [2] for development / explanation. Possible human reasons include: • agricultural • industrial • settlement. For example: Runoff from farming into particular parts of the lake [1] carries high amounts of nitrates [1] that were used as fertilizer [1]. Possible physical reasons include: • drainage patterns • wind / storms / currents • hydrological flows • relief • depth/temperature of water. For example: An area of water with many rivers draining into it [1] will receive more inputs of dissolved nutrients in solution [1], leading to excessive algae growth in that part of the lake [1].

Natural recharge happens through normal percolation after rainfall/snowfall [1] and/or a gradual seepage from rivers or other water bodies [1]. Credit any valid extension of either point or any comment that relates to the geology/porosity of rock [1] of the area that allows downward movement of water

In each case, award [1] for valid consequence and [1] for further explanation/detail. Possible consequences include: may be very costly for farmers [1] as yields of crops may decrease / as may have to add expensive artificial fertilizers [1] salinity may affect the structure of the soil [1], resulting in surface soil compaction [1] loss of vegetation cover [1] may expose the area to the effects of soil erosion [1]. For example: Crops tend to have low salt tolerance [1] so salinization reduces crop yield/makes it less productive [1].

Water found below the surface of the earth [1 mark].

(c) Explain one human reason and one physical reason why some areas of a freshwater lake such as this experience high levels of eutrophication.[10]

In each case, award [1] for the reason and up to [2] for development / explanation. Possible human reasons include: • agricultural • industrial • settlement. For example: Runoff from farming into particular parts of the lake [1] carries high amounts of nitrates [1] that were used as fertilizer [1]. Possible physical reasons include: • drainage patterns • wind / storms / currents • hydrological flows • relief • depth/temperature of water. For example: An area of water with many rivers draining into it [1] will receive more inputs of dissolved nutrients in solution [1], leading to excessive algae growth in that part of the lake [1].

ii) State two methods that can be used to artificially recharge an aquifer. [2]

Through creation of recharge basin lakes [1] or water pumped down the bore hole [1]. Credit any other logical reason why more water could be introduced to a region where an aquifer is present, eg drainage diversion [1].