4.2 Water access, use and security

Name: _____ Class: _____ Date: _____ **Total: 21 marks**

KEY WORDS freshwater • water security • water scarcity • virtual water • water footprint • desalination

Objective

Build the skills to answer exam questions on **water access**, use and **water security**: freshwater supply, scarcity, water footprints, and strategies to meet demand.

You must be able to:

- describe how little of Earth's water is accessible freshwater, and how it is used
- tell physical from economic water scarcity
- calculate and compare water footprints, including virtual water
- evaluate strategies to improve water security, including transboundary issues

1 Key knowledge and worked examples

■ Water access and security

Only about 2.5% of Earth's water is fresh, and most of that is frozen or deep underground; less than 1% is easy to reach in rivers, lakes and shallow groundwater.

Worldwide, about 70% of freshwater withdrawal is for **agriculture** (irrigation), about 20% for **industry** and about 10% for **domestic** use.

Water security means reliable access to enough safe water for health, livelihoods and ecosystems.

scarcity	cause	example
physical	not enough water in the region	arid regions, overused rivers
economic	water exists, but no money or infrastructure to supply it	many rural areas with rivers but no pipes or treatment

Water footprint: the total volume of freshwater used to make a product or used by a person, including **virtual water** – the water "hidden" in goods (e.g. about 15 000 litres for 1 kg of beef, about 1 800 litres for 1 kg of wheat; global averages).

strategy	for	against
dams and reservoirs	store water, hydro power	displace people, trap sediment, harm fish
desalination	unlimited sea water	energy-intensive, salty brine waste
drip irrigation	less waste	cost for farmers
rainwater harvesting, grey-water reuse	cheap, local	small scale
pricing and education	less waste	can hurt the poor

Rivers that cross borders (e.g. the Nile, the Mekong) can cause conflict when an upstream country builds a dam; agreements share the water.

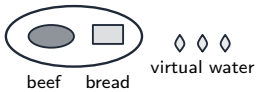
Answer shapes: name the strategy, say how it raises supply or cuts demand, then one cost.

2 Practice

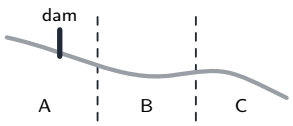
2.1 Distinguish between physical and economic water scarcity. [2]



2.2 A person eats 0.2 kg of beef and 0.5 kg of wheat products a day. Using 15 000 L kg^{-1} for beef and 1 800 L kg^{-1} for wheat, calculate the daily virtual water in this food, and suggest **one** way to reduce it. [3]



2.3 An upstream country builds a large dam on a river that flows through two other countries. Explain **three** possible effects on the downstream countries. [3]

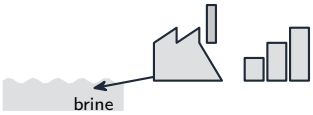


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3 Exam-style questions

3.1 A coastal city in a dry region plans to build a desalination plant.

(a) Explain **one** advantage and **one** disadvantage of desalination. [2]



(b) Suggest **two** other strategies the city could use to improve its water security. [2]

3.2 The pie chart shows water withdrawal by sector in a country.

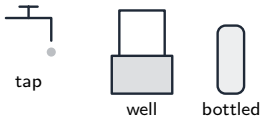
(a) Identify the sector where saving water would have the largest effect. [1]

(b) Evaluate drip irrigation as a way to improve water security in this country. [4]



3.3 Water security can be measured in different ways.

Discuss whether water security is more a problem of supply or of management. [4]



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Solutions

Marking: **M1** a correct method, **A1** the correct answer, **B1** an independent mark.

Each answer shows the steps, then the **result**.

2.1

physical: there is not enough water to meet demand, e.g. in dry regions; economic: water is available, but people lack money or infrastructure to access it

2.2

$0.2 \times 15\,000 = 3000$ L and $0.5 \times 1\,800 = 900$ L; total **3900** L a day; eat less beef / replace some beef with plant protein

2.3

less water reaches them while the reservoir fills or in dry years; less sediment and nutrients reach farmland and deltas, which may shrink; possible tension or conflict over water rights, needing an agreement; but floods may be controlled

3.1

(a) advantage: a reliable supply not depending on rain; disadvantage: uses much energy (often from fossil fuels) / salty brine harms marine life / expensive

(b) any two: repair leaking pipes; recycle waste water; rainwater harvesting; water pricing and education; drip irrigation on nearby farms

3.2

(a) agriculture

(b) award up to [4]: delivers water to the roots, so much less is lost by evaporation and runoff; in the largest sector, so the national saving can be large; but costly to install and maintain for poor farmers; farmers may use the saved water to irrigate more land, so total use may not fall; conclusion: effective with support (subsidies) and limits on total withdrawal

3.3

award up to [4]: supply: some regions are physically dry, and climate change makes rainfall less reliable; management: many shortages are economic, caused by lack of pipes, treatment and investment, or by waste and pollution; unfair access and pricing, and upstream use, decide who gets water; conclusion: in most places management and fairness matter more than total supply