2.4 Water, food and energy security

Name: _____ Class: _____ Date: _____ **Total: 30 marks**

KEY WORDS water security • food security • energy security • water–food–energy nexus - -

Objective

Build the skills to answer exam questions on **water security** , **food security** and **energy security** , the **water–food–energy nexus** - - , and how places try to make their supplies secure.

You must be able to:

- distinguish physical and economic water insecurity with named places
- explain the four pillars of food security
- explain energy security and how a country can improve it
- explain links in the water–food–energy nexus with an example
- evaluate a strategy to improve resource security

1 Key knowledge and worked examples

Water, food and energy

- **Water security**: enough safe water at a fair price. Farming uses about **70 %** of the fresh water people withdraw. **Physical** water insecurity: too little water (the Middle East). **Economic** water insecurity: water exists but people cannot afford pipes and pumps (parts of sub-Saharan Africa).
- **Food security** has four pillars: **availability** (enough is produced or imported), **access** (people can afford and reach it), **utilization** (safe, nutritious food the body can use) and **stability** (all three last through bad years). A famine can happen when there is food in a country but poor people cannot afford it.
- **Energy security**: a reliable supply at an affordable price. China imports about **70 %** of the crude oil it uses, much of it by sea, one reason it invests in solar, wind, nuclear power and electric cars.

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The nexus

The three depend on each other: farms need water and energy (pumps, fertilizer); power stations need water for cooling; dams store water and make electricity. Growing maize for biofuel saves oil but uses farmland and water that could grow food.

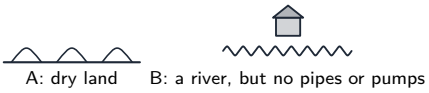
strategy	security improved	limit
desalination	water	needs a lot of energy; salty waste
drip irrigation	water and food	cost for small farmers
solar and wind	energy (and less CO_2)	output varies; needs storage
more than one supplier	energy, food	can be more expensive

Worked example. A farm withdraws 7,000 m^3 of water a year; drip irrigation cuts this by 30 %. Saving $= 0.30 \times 7{,}000 = 2{,}100$ m^3; new use $= 4{,}900$ m^3.

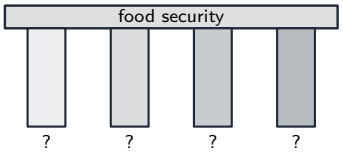
Answer shape for "explain a link": resource 1 → what it needs from resource 2 → a named example → the effect on security.

2 Practice

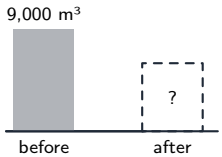
2.1 Distinguish between **physical** and **economic** water insecurity. [2]



2.2 Outline the **four** pillars of food security. [3]

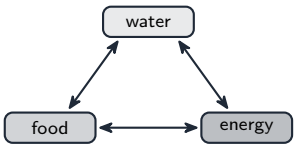


2.3 A farm withdraws 9,000 m^3 of water a year. Drip irrigation cuts its use by 40 %. Calculate the new water use. [2]



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2.4 Explain **one** link between water and energy in the water–food–energy nexus. [3]



2.5 China imports about 70 % of the crude oil it uses. Explain **two** ways China is trying to improve its energy security. [4]

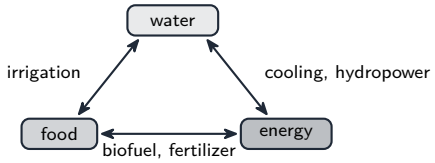


3 Exam-style questions

3.1 *(Paper 2 style.)* The diagram shows the water–food–energy nexus.

(a) Using **one** example, explain how using a resource for energy can reduce food security. [2]

(b) Explain **two** reasons why food insecurity can happen in a country that produces enough food. [4]



3.2 Evaluate the strategies used to improve water security in places you have studied. [10]

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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 in the area for people's needs, e.g. desert countries of the Middle East; economic: water exists, but people cannot afford the pipes, pumps or treatment to use it, e.g. parts of sub-Saharan Africa

2.2

availability: enough food produced or imported; access: people can afford and reach it; utilization: safe and nutritious food the body can use; stability: all three continue through bad years, e.g. droughts or price rises

2.3

saving $= 0.40 \times 9{,}000 = 3{,}600$ m^3; new use $= 9{,}000 - 3{,}600 =$ **5,400** m^3

2.4

any one link, developed: power stations need large amounts of water for cooling, so in a drought they may have to cut output, e.g. lower river levels limiting power stations or hydropower; or: pumping, moving and desalinating water uses energy, so water supply depends on an energy supply, e.g. desalination plants in the Gulf states run on oil and gas

2.5

any two, explained: building solar and wind power, so less oil and gas has to be imported; electric cars cut the need for imported petrol; nuclear power gives a steady domestic supply; oil from several countries and by pipeline as well as by sea, so one blocked route does not stop supply

3.1

(a) growing maize (or sugar cane) for biofuel uses farmland and water that could grow food, which can raise food prices

(b) any two, explained: poor people cannot afford food when prices rise faster than wages, e.g. Sen on the Bengal famine of 1943; food cannot reach people because of poor roads or conflict, so access fails even though food exists; food is lost after harvest because of poor storage; unsafe water or disease means the body cannot use the food (utilization)

3.2

Mark with the markbands: [9-10] focused on the command term, detailed and accurate knowledge, well-developed explanation, specific named examples (places, dates, numbers), balanced evaluation and a supported conclusion; [7-8] mostly focused, good knowledge and examples, some evaluation; [5-6] relevant knowledge and examples, explanation partly developed, little evaluation; [3-4] general knowledge, few examples, mostly description; [1-2] little that is relevant. Points that may be included: dams and reservoirs store water and make electricity, e.g. the Three Gorges Dam; but they flood land and move

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people (about 1.3 million) and trap sediment; desalination supplies cities in dry places such as the Gulf states; but it uses a lot of energy and produces salty waste, so it links water to energy security; drip irrigation cuts farm water use, which is about 70 % of withdrawals; but small farmers may not afford it; water transfers move water between basins, e.g. China's South–North Water Transfer Project; pricing and cutting leaks reduce waste in cities, but higher prices can hurt the poor (economic water insecurity); conclusion: technical strategies increase supply, but water security lasts only with saving water and fair prices; the best choice depends on whether the problem is physical or economic

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