C10F Using Resources: Foundation Tier Practice

AQA 8462 · Calculator allowed · about 80 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Potable water is water that is safe for humans to drink.

State whether potable water is the same as pure water, and explain your answer.

(Total for Question 1 is 2 marks)

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2 The UK mostly obtains potable water from rain that collects in the ground and in rivers and lakes, which naturally contains few dissolved substances.

Describe the main stages used to treat this fresh water and make it safe to drink.

(Total for Question 2 is 3 marks)

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3 In some countries, seawater must be used to produce potable water because there is not enough fresh water available.

State one method used to remove salt from seawater (desalination), and give one disadvantage of this method.

(Total for Question 3 is 2 marks)

4 Distillation can be used to desalinate seawater. State the process that happens to the water during distillation, and explain why the salt is left behind.

(Total for Question 4 is 2 marks)

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5 Waste water, including sewage from homes and businesses, must be treated before it is released back into the environment.

Describe the main stages of sewage (waste water) treatment.

(Total for Question 5 is 3 marks)

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6 A town is deciding between using local river water or seawater as its source for producing potable water.

Give one reason why treating fresh water from a river is usually cheaper than desalinating seawater.

(Total for Question 6 is 1 mark)

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7 A Life Cycle Assessment (LCA) is used to assess the environmental impact of a product across its whole lifetime.

State the four main stages of a product's life cycle that are considered in an LCA.

(Total for Question 7 is 4 marks)

8 A company carries out an LCA to compare a plastic shopping bag with a paper shopping bag. The table below shows some data from the LCA.

Plastic bag: energy to make one bag = 2.0 MJ; can be reused 20 times before disposal.
Paper bag: energy to make one bag = 4.5 MJ; can be reused 4 times before disposal.

(a) Calculate the energy used per use of the plastic bag.
(b) Calculate the energy used per use of the paper bag.
(c) State which bag has the lower energy cost per use.

(Total for Question 8 is 5 marks)

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9 Explain why an LCA is described as being difficult to carry out with complete objectivity (some parts rely on estimates or judgements).

(Total for Question 9 is 2 marks)

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10 Recycling metals, such as aluminium and steel cans, has clear environmental and economic benefits.

Give two reasons why it is important to recycle metals rather than only extracting new (finite) metal ore from the ground.

(Total for Question 10 is 2 marks)

11 A recycling plant collects 850 kg of scrap aluminium in one day. Melting and recycling this aluminium uses 0.70 MJ of energy per kg. Extracting the same mass of new aluminium from ore would use 4.5 MJ per kg.

Calculate the total energy saved, in MJ, by recycling the 850 kg of aluminium instead of extracting new aluminium.

(Total for Question 11 is 3 marks)

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12 Copper can be extracted from low-grade ores (ores containing only a small percentage of copper) using methods other than traditional mining and smelting.

State the name of one alternative method of extracting copper from a low-grade ore, and briefly describe how it works.

(Total for Question 12 is 1 mark)

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13 State one advantage of alternative methods of copper extraction, such as phytomining or bioleaching, compared with traditional mining.

(Total for Question 13 is 1 mark)

14 Extended response (6 marks).

A supermarket is deciding whether to switch from single-use plastic shopping bags to reusable cotton tote bags.

Explain the environmental factors the supermarket should consider when making this decision, using ideas about life cycle assessment, resource use and disposal.

(Total for Question 14 is 6 marks)

Mark scheme · C10F Using Resources: Foundation Tier Practice

Question 1

- **B1** no, potable water is not the same as chemically pure water
- **B1** potable water contains low, safe levels of dissolved substances (minerals/salts) and is safe to drink, whereas chemically pure water contains only H2O with nothing dissolved in it, oe
- **Answer: No. Potable water is safe to drink and contains low levels of dissolved substances, but chemically pure water contains only H2O.**

Question 2

- **B1** choose a suitable water source (e.g. river, lake or reservoir)
- **B1** pass the water through filter beds (filtration) to remove solid particles/debris
- **B1** sterilise the water to kill microbes/harmful microorganisms, e.g. using chlorine, ozone or ultraviolet light
- **Answer: Choose a suitable fresh water source, filter it to remove solids, then sterilise it (for example with chlorine, ozone or UV light) to kill harmful microorganisms.**

Question 3

- **B1** distillation or reverse osmosis (accept either)
- **B1** disadvantage: it requires large amounts of energy, which is expensive and (if from fossil fuels) has a negative environmental impact, oe
- **Answer: For example: distillation. This uses a large amount of energy, making it expensive and potentially damaging to the environment.**

Question 4

- **B1** the seawater is heated so the water evaporates (boils), then the water vapour is cooled and condensed to collect pure liquid water, oe
- **B1** the dissolved salt does not evaporate with the water (it has a much higher boiling point), so it is left behind in the original container, oe
- **Answer: The water is evaporated (boiled) then condensed and collected as pure water. The salt stays behind because it does not evaporate with the water.**

Question 5

- **B1** screening and grit removal, to take out large solid objects and grit
- **B1** sedimentation, where the remaining solids settle out to produce sludge and effluent (liquid waste water)
- **B1** the sludge is treated separately by anaerobic digestion (by anaerobic bacteria), and the effluent is treated by aerobic biological treatment (using aerobic bacteria to break down organic matter), oe
- **Answer: Screening and grit removal, then sedimentation to separate sludge from effluent; the sludge is treated by anaerobic digestion and the effluent is treated by aerobic biological treatment.**

Question 6

- **B1** fresh water already contains few dissolved substances, so it only needs filtration and sterilisation, whereas seawater has a high concentration of dissolved salts that must be removed, which needs much more energy (e.g. for distillation), oe
- **Answer: River water already has low levels of dissolved substances so it only needs simple filtering and sterilising, while seawater needs energy-intensive desalination to remove the salt.**

Question 7

- **B1** extracting and processing raw materials
- **B1** manufacturing and packaging (making the product)
- **B1** using the product (use and operation)
- **B1** disposing of the product at the end of its life
- **Answer: Extracting and processing raw materials; manufacturing and packaging; use of the product; and disposal of the product.**

Question 8

- **M1** (a) substitutes: 2.0 / 20
- **A1** (a) 0.10 MJ per use cao
- **M1** (b) substitutes: 4.5 / 4
- **A1** (b) 1.125 MJ per use (accept 1.1 MJ) cao
- **B1** (c) the plastic bag has the lower energy cost per use
- **Answer: (a) 0.10 MJ per use. (b) 1.125 MJ per use. (c) The plastic bag.**

Question 9

- **B1** some factors, such as the environmental effect of water use, or the impact of noise or visual pollution, are hard to measure precisely and give a numerical value to, oe
- **B1** so different companies or assessors may make different judgements/estimates for these factors, which can allow selective (biased) LCAs to be produced, oe
- **Answer: Some environmental impacts (e.g. pollution or water use) are hard to measure precisely, so assessors must estimate or judge their size, which means different LCAs for the same product can reach different conclusions.**

Question 10

- **B1** conserves (finite) metal ore resources, which will otherwise eventually run out, oe
- **B1** recycling uses less energy than extracting and processing new metal from ore, which reduces cost and reduces the use of fossil fuels/carbon dioxide emissions, oe
- **Answer: Recycling saves finite metal ore resources for the future, and it uses much less energy than extracting new metal, saving cost and reducing carbon dioxide emissions.**

Question 11

- **M1** calculates energy saved per kg: 4.5 - 0.70 = 3.8 MJ per kg
- **M1** substitutes: total saved = 3.8 x 850
- **A1** 3230 MJ cao
- **Answer: 3230 MJ**

Question 12

- **B1** phytomining: growing plants on soil that contains copper; the plants absorb copper compounds through their roots; the plants are then harvested and burned, and the copper compounds are collected from the ash, oe (accept bioleaching: using bacteria to produce a solution containing copper compounds, which is then processed to obtain copper)
- **Answer: For example, phytomining: plants are grown on land containing copper; they absorb copper compounds, and burning the harvested plants leaves ash from which copper can be obtained.**

Question 13

- **B1** they allow copper to be extracted from ores that have too little copper to be worth mining traditionally, and they generally cause less damage to the landscape than traditional mining, oe
- **Answer: They make use of low-grade ores that would otherwise be uneconomic to mine, and they generally cause less environmental damage than traditional mining.**

Question 14

- **Level 3** (5-6): A well-organised explanation covering raw material extraction, manufacturing energy, number of reuses, and end-of-life disposal for both bag types, reaching a supported conclusion.
- **Level 2** (3-4): Several relevant factors are given (e.g. reuse, disposal) with some explanation, but the answer is not fully balanced across both bag types or lacks a clear conclusion.
- **Level 1** (1-2): Simple statements, e.g. 'cotton bags are better for the environment', with little explanation or use of LCA ideas.
- **Indicative content:**
  - Cotton tote bags require growing cotton, which uses land, water and fertiliser, and processing this raw material takes more energy to manufacture than a single plastic bag.
  - Plastic bags are made from crude oil, a finite (non-renewable) resource, and their manufacture uses less energy per bag than a cotton bag, but plastic does not biodegrade easily.
  - The overall environmental impact depends heavily on how many times each bag is reused: a cotton bag must be reused many times (compared with a single-use plastic bag) before its higher manufacturing impact is 'paid back'.
  - At disposal, plastic bags can persist in the environment for a long time and may contribute to litter and harm to wildlife if not recycled, while cotton bags will eventually biodegrade.
  - A full life cycle assessment should be carried out (covering raw material extraction, manufacture, use/reuse and disposal for both types) rather than assuming cotton is automatically 'better', because a cotton bag used only a few times could have a higher overall environmental impact than many uses of a plastic bag.
  - A supported conclusion should recommend the option based on realistic expected reuse (e.g. cotton bags are only the better choice if customers genuinely reuse them many times).