2.5 Using Resources: 30-minute Pack

AQA 8462 · Calculator allowed · about 30 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Waste water from homes and industry must be treated before it is safely released back into rivers.

(a) Describe the stages used to treat waste water, from screening to the treatment of sludge and effluent. **(4)**

(Total for Question 1 is 4 marks)

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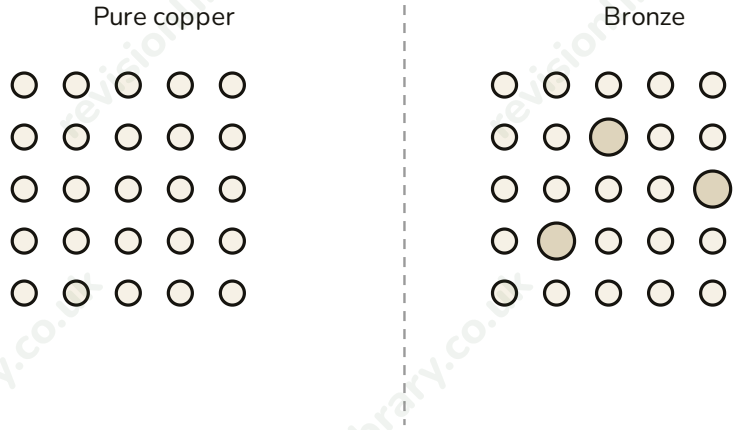
2 A Life Cycle Assessment (LCA) is used to assess the environmental impact of a product across its whole lifetime.

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

(Total for Question 2 is 4 marks)

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3 Bronze is an alloy of copper and tin, and is much harder than pure copper.



(a) State what is meant by the term 'alloy'. **(2)**

(b) Explain, in terms of particle arrangement, why bronze is harder than pure copper. **(2)**

(Total for Question 3 is 4 marks)

4 Manufacturers use life cycle assessments (LCAs) to compare the environmental impact of products.

(a) State what a life cycle assessment is used for. **(1)**

(b) List the four main stages of a life cycle assessment. **(3)**

(Total for Question 4 is 4 marks)

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5 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 5 is 3 marks)

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6 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 6 is 6 marks)

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Mark scheme · 2.5 Using Resources: 30-minute Pack

Question 1

(a) screening and grit removal takes out large solid objects and grit (oe) **B1**

(a) sedimentation produces sludge (settled solids) and effluent (the remaining liquid) (oe) **B1**

(a) the sludge is treated by anaerobic digestion, which can produce biogas (oe) **B1**

(a) the effluent is treated by aerobic digestion (using bacteria/microorganisms) before being released (oe) **B1**

(a) Answer: Screening and grit removal takes out large solids and grit. Sedimentation then separates the water into sludge and effluent. The sludge is treated by anaerobic digestion (which can produce biogas), and the effluent is treated aerobically by microorganisms before being released.

Question 2

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 **B1**

Answer: Extracting and processing raw materials; manufacturing and packaging; use of the product; and disposal of the product.

Question 3

(a) a mixture (usually) of two or more metals, or a metal and another element (oe) **B1**

(a) made by melting the metals together and then allowing them to cool/solidify (oe) **B1**

(a) Answer: An alloy is a mixture of two or more metals (or a metal and another element), made by melting them together and allowing the mixture to cool and solidify.

(b) in pure copper, atoms are arranged in regular layers of the same size, which can slide over each other easily (oe) **B1**

(b) the tin atoms in bronze are a different size to the copper atoms, which distorts the layers and makes it harder for them to slide over each other (oe) **B1**

(b) Answer: In pure copper, all the atoms are the same size and arranged in regular layers that can slide over each other easily. The tin atoms added in bronze are a different size, which distorts the layers, making it harder for them to slide, so bronze is harder than pure copper.

Question 4

(a) to assess/compare the environmental impact of a product across all stages of its life (oe) **B1**

(a) Answer: A life cycle assessment is used to assess the environmental impact of a product across all the stages of its life.

(b) extracting and processing raw materials **B1**

(b) manufacturing and packaging the product **B1**

(b) use and operation of the product during its lifetime, and its disposal at the end of life (oe; accept as two points across this mark and any spare credit) **B1**

(b) Answer: Extracting and processing raw materials; manufacturing and packaging; use and operation during the product's lifetime; disposal at the end of its life.

Question 5

calculates energy saved per kg: 4.5 - 0.70 = 3.8 MJ per kg **M1**

substitutes: total saved = 3.8 x 850 **M1**

3230 MJ cao **A1**

Answer: 3230 MJ

Question 6

Level 3 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. **5-6**

Level 2 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. **3-4**

Level 1 Simple statements, e.g. 'cotton bags are better for the environment', with little explanation or use of LCA ideas. **1-2**

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).

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