Water and use of resources

AQA GCSE Chemistry (8462) · Foundation and Higher

Show your working where needed. Check the worked answers when you finish.

Name _____ Date _____

1. Potable water

A treated water sample still contains some dissolved mineral salts. Explain what makes water potable and why the presence of dissolved salts does not automatically make it unsafe.

2. Two jobs in water treatment

A fresh-water supply contains suspended solid particles and microorganisms. Name a process that removes many insoluble particles and a process that reduces the risk from microorganisms.

3. The condenser and the flask

A sample of seawater is purified by simple distillation. Explain why water can be collected at the condenser outlet and where the dissolved salt ends up.

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4. Compare dissolved solids

A pupil evaporates 40 cm^3 of sample A and obtains 0.080 g of dry residue. Evaporating 80 cm^3 of sample B leaves 0.120 g. Which sample contains more dissolved solid per cm^3? Use both measurements in your working.

5. Checking a bottle comparison

A company says a new drinks bottle has a lower impact based on the energy used at the factory. State three other life-cycle stages to include and suggest an environmental impact to compare at one of those stages.

6. Two stages of sewage treatment

After solids have settled, the sludge and the liquid effluent go into separate tanks. In one tank air is pumped in, and the other tank excludes oxygen. Match each product to its tank and name both types of biological treatment.

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7. Evidence for choosing packaging

To provide the same service 100 times, packaging A causes 8 kg CO_2 equivalent of emissions and uses 60 L of water. B causes 5 kg and uses 90 L. Which better meets a target to reduce emissions? Use both sets of figures to explain why another buyer might choose differently.

8. Reuse makes the comparison fair

A reusable container has a production footprint of 2.4 kg CO_2 equivalent. Each use adds 0.04 kg from washing. A disposable one adds 0.18 kg per use. Compare their footprints for 20 uses. State one assumption.

9. Extra challenge · Make the same service comparison

A single-use cup causes 0.12 kg CO_2 equivalent per drink. A reusable cup causes 1.44 kg when made and 0.04 kg each time it is washed and used.

Find the first whole number of uses for which the reusable cup gives the smaller total. Explain how a real change in washing or disposal could affect the conclusion.

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Worked answers

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1. Potable water

Potable water is safe to drink. Its dissolved substances and microorganisms must be at safe levels. Potable water can contain dissolved minerals.

2. Two jobs in water treatment

Filtration removes suspended solid particles. Sterilisation, for example using chlorine, reduces the risk from microorganisms.

3. The condenser and the flask

Water vaporises in the heated flask. Its vapour cools and condenses in the condenser, so liquid water leaves the outlet. The salt stays behind in the flask because it does not vaporise under these conditions.

4. Compare dissolved solids

A: 0.080 ÷ 40 = 0.0020 g/cm^3. B: 0.120 ÷ 80 = 0.0015 g/cm^3. A has the higher concentration of dissolved solids, although B left a larger mass from a larger sample.

5. Checking a bottle comparison

Include extracting and processing raw materials, using the bottle and dealing with it at the end of its life. For example, compare water use for washing during use, or waste sent to landfill after disposal.

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Worked answers

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6. Two stages of sewage treatment

Liquid effluent goes into the aerated tank for aerobic biological treatment. The sludge goes into the tank without oxygen for anaerobic digestion.

7. Evidence for choosing packaging

B saves 3 kg CO_2 equivalent for the same service. A uses 30 L less water, so an organisation that gives priority to water use could choose A.

8. Reuse makes the comparison fair

Reusable = 2.4 + (20 × 0.04) = 3.2 kg CO_2 equivalent. Disposable = 20 × 0.18 = 3.6 kg. The reusable option is lower by 0.4 kg. This assumes the same service per use and that the reusable container lasts for all 20 uses.

9. Extra challenge · Make the same service comparison

For n drinks the totals are 0.12n and 1.44 + 0.04n kg. They match at 1.44 ÷ 0.08 = 18 uses. At 19 uses the totals are 2.28 kg and 2.20 kg, so the reusable cup is first lower at 19.

Hotter or less efficient washing could increase the emissions per reusable use. A different end-of-life treatment for either cup would affect the total. The comparison assumes each cup provides the same service.

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