2.5 Using Resources: Test Pack

AQA 8462 · Calculator allowed · about 40 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 Tap water in the UK is described as potable water.

(a) State what is meant by the term 'potable water'. **(1)**

(b) Explain why potable water is not the same as pure water. **(2)**

(Total for Question 1 is 3 marks)

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2 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 2 is 2 marks)

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3 Different materials are chosen for different products depending on their properties.

(a) Identify one material from each pair that is more suitable for the job described, and give a reason for each choice: (i) a soup bowl - soda-lime glass or borosilicate glass, (ii) a plastic drinks bottle - a thermosoftening or a thermosetting polymer, (iii) a bicycle frame - a carbon-fibre composite or a pure metal, (iv) an electrical wall socket - a thermosetting polymer or a thermosoftening polymer. **(4)**

(Total for Question 3 is 4 marks)

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4 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 4 is 2 marks)

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5 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 5 is 3 marks)

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6 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 6 is 2 marks)

7 Ammonia produced by the Haber process is used to manufacture ammonium nitrate fertiliser.

(a) Write the word equation for the reaction between ammonia and nitric acid to form ammonium nitrate. **(1)**

(b) State the type of reaction taking place between ammonia and nitric acid. **(1)**

(c) Give one reason why ammonium nitrate is a particularly useful compound to use as a fertiliser. **(1)**

(Total for Question 7 is 3 marks)

8 In some countries with limited fresh water, potable water is produced from sea water by desalination.

(a) Name two methods used to desalinate sea water. **(2)**

(b) Compare distillation and reverse osmosis as methods of desalination, in terms of the energy they require. **(2)**

(Total for Question 8 is 4 marks)

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9 Iron and steel structures, such as bridges and railings, can corrode over time.

(a) State the two substances that must both be present for iron to rust. **(2)**

(b) Write a word equation for the rusting of iron. **(2)**

(Total for Question 9 is 4 marks)

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10 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 10 is 1 mark)

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11 Ammonium nitrate, NH_4NO_3, is a common nitrogen-based fertiliser made industrially using ammonia produced by the Haber process. Relative atomic masses: N = 14, H = 1, O = 16.

(a) Calculate the relative formula mass (Mr) of ammonium nitrate, NH_4NO_3. **(1)**

(b) Calculate the percentage by mass of nitrogen in ammonium nitrate. Give your answer to the nearest whole number. **(2)**

(Total for Question 11 is 3 marks)

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Mark scheme · 2.5 Using Resources: Test Pack

Question 1

(a) water that is safe (enough) for humans to drink (oe; accept low enough levels of dissolved salts/microbes/other substances) **B1**

(a) Answer: Potable water is water that is safe for humans to drink.

(b) pure water contains only H_2O molecules with nothing dissolved in it (oe) **B1**

(b) potable water contains low, safe levels of dissolved substances such as mineral ions/salts, whereas pure water by definition has none (oe) **B1**

(b) Answer: Pure water is H_2O with nothing else dissolved in it, whereas potable water still contains low, safe levels of dissolved substances such as mineral salts; it is safe to drink but not chemically pure.

Question 2

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 H_2O with nothing dissolved in it, oe **B1**

Answer: No. Potable water is safe to drink and contains low levels of dissolved substances, but chemically pure water contains only H_2O.

Question 3

(a) (i) borosilicate glass, because it can withstand large temperature changes without cracking (oe) **B1**

(a) (ii) a thermosoftening polymer, because it can be melted and remoulded/recycled easily (oe) **B1**

(a) (iii) a carbon-fibre composite, because it is strong but much less dense/lighter than most pure metals (oe) **B1**

(a) (iv) a thermosetting polymer, because it does not melt/soften when heated, so it is safer near an electrical current (oe) **B1**

(a) Answer: (i) Borosilicate glass, as it resists thermal shock; (ii) a thermosoftening polymer, as it can be melted and remoulded/recycled; (iii) a carbon-fibre composite, as it is strong but much lighter than metal; (iv) a thermosetting polymer, as it does not melt when heated, making it safer around electricity.

Question 4

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 **B1**

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 5

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 **B1**

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 6

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 **B1**

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 7

(a) ammonia + nitric acid -> ammonium nitrate **B1**

(a) Answer: ammonia + nitric acid -> ammonium nitrate

(b) neutralisation (acid-base reaction) (oe) **B1**

(b) Answer: It is a neutralisation (acid-base) reaction.

(c) it provides nitrogen from both the ammonium ion and the nitrate ion, so it has a high percentage of nitrogen for plant growth (oe) **B1**

(c) Answer: It contains nitrogen in both the ammonium ion and the nitrate ion, giving it a high percentage of nitrogen, which plants need to grow.

Question 8

(a) distillation **B1**

(a) reverse osmosis (using membranes) **B1**

(a) Answer: Distillation and reverse osmosis.

(b) distillation requires large amounts of energy to evaporate/boil the water (oe) **B1**

(b) reverse osmosis requires energy to force water through the membrane at high pressure, but this is usually less than the energy needed for distillation (oe) **B1**

(b) Answer: Distillation needs a large amount of energy to boil the water so it can be condensed as pure water; reverse osmosis needs energy to pump water through membranes at high pressure, but this is generally less energy than distillation requires.

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Question 9

(a) oxygen (from the air) **B1**

(a) water **B1**

(a) Answer: Oxygen and water must both be present for iron to rust.

(b) iron, water and oxygen identified as reactants **M1**

(b) iron + water + oxygen -> hydrated iron oxide (oe; accept 'rust' in place of 'hydrated iron oxide') cao **A1**

(b) Answer: iron + water + oxygen -> hydrated iron oxide (rust)

Question 10

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 **B1**

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 11

(a) 14 + (4 x 1) + 14 + (3 x 16) = 80 cao **B1**

(a) Answer: 80

(b) substitutes total mass of N = 2 x 14 = 28 into %N = (28 / 80) x 100 **M1**

(b) 35% cao **A1**

(b) Answer: 35%

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