AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.10.2.2

Ways of reducing the use of resources

Past-paper questions

Tier	**Foundation**
Question groups	**41**
Available paper years	**2007–2022**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.10.2.2 Ways of reducing the use of resources

Question 01

January 2007 | CHY1F | Original Q4 | Legacy

4 Limestone contains calcium carbonate.

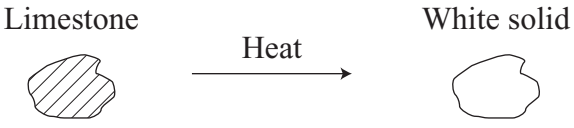
(a) Calcium carbonate has the formula $CaCO_3$.

Complete the sentence by writing in the correct numbers.

The formula of calcium carbonate is made up of 1 calcium atom, ... carbon atom(s) and ..... oxygen atom(s).

(2 marks)

(b) When limestone is heated it forms two other compounds.



$$\mathbf{CaCO_3} \rightarrow \mathbf{CaO} + \mathbf{CO_2}$$

(i) State **one** safety precaution that you should take when heating limestone.

.....

(1 mark)

(ii) Name the white solid produced.

.....

(1 mark)

(iii) Why does a piece of limestone lose mass as it is heated?

.....

.....

(1 mark)

4.10.2.2 Ways of reducing the use of resources

Question 01 · continued

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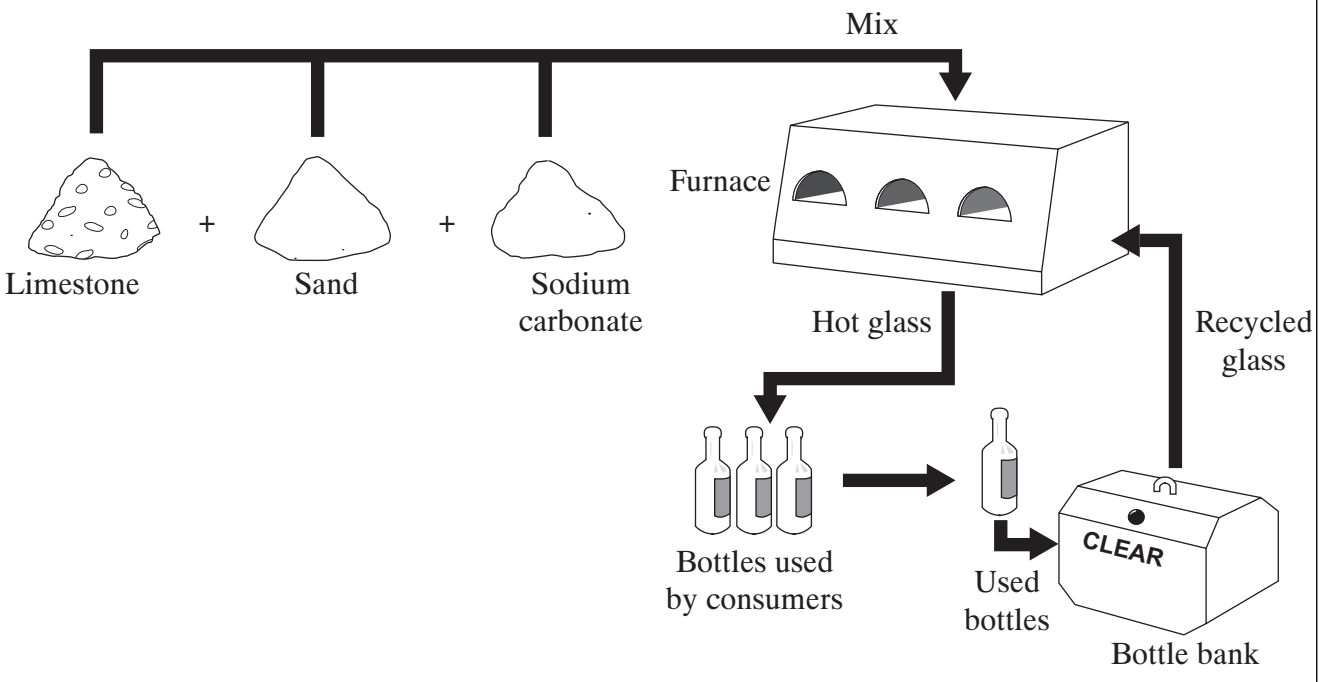
(c) Limestone is used to manufacture glass. Glass is made by heating a mixture of limestone, sand and sodium carbonate in a furnace.
The reaction requires a high temperature. If some recycled glass is added, the reaction takes place at a lower temperature.



Suggest **two** reasons why people are encouraged to recycle glass.

1 .....

.....

2 .....

.....

(2 marks)

Question 4 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 01 · continued

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(d) A company wants to quarry limestone. There are some houses near the quarry.



Residents in the houses say that they do not want a quarry next to them.

(i) Suggest **two** reasons why they do not want the quarry next to them.

1 .....

.....

2 .....

.....

(2 marks)

(ii) Suggest **one** possible benefit to the residents of having a quarry near their houses.

.....

.....

(1 mark)

10

4.10.2.2 Ways of reducing the use of resources

Question 02

March 2007 | CHY1A | Original Q9 | Legacy

QUESTION NINE

Aluminium can be obtained by extracting it from aluminium ore, and by recycling used objects made from aluminium.

9A One disadvantage of extracting aluminium from aluminium ore is that . . .

1 aluminium ore contains very small amounts of aluminium.

2 aluminium ore is a limited resource.

3 the aluminium obtained corrodes easily.

4 the aluminium obtained has a high density.

9B It is better to recycle aluminium than to extract it from aluminium ore because . . .

1 aluminium ore contains few impurities.

2 aluminium ore produces low grade aluminium.

3 digging up aluminium ore destroys the local environment.

4 recycling produces ‘smart’ aluminium alloys.

9C It makes economic sense to recycle aluminium because extracting it from its ore . . .

1 is a cheap process.

2 takes too long.

3 employs more people.

4 uses large amounts of energy.

9D If aluminium cans are not recycled, they can affect the environment by . . .

1 causing acid rain.

2 filling up landfill rubbish tips.

3 producing poisonous gases.

4 rapidly corroding in lakes and rivers.

END OF TEST

4.10.2.2 Ways of reducing the use of resources

Question 03

June 2007 | CHY1F | Original Q7 | Legacy

7 Copper is a widely used metal. The main ore of copper contains copper sulfide. Copper can be extracted from copper sulfide in a three stage process.

(a) In the first stage of extraction the copper sulfide is heated in air.

(i) Balance the symbol equation for the reaction.

$$Cu_2S + ...O_2 \rightarrow .....CuO + SO_2$$

(1 mark)

(ii) Explain why there would be an environmental problem if the gas from this reaction were allowed to escape into the atmosphere.

.....

.....

.....

.....

(2 marks)

(b) In the second stage copper oxide, CuO, is reduced using carbon.

Describe and explain what happens during this reaction.

.....

.....

.....

.....

(2 marks)

4.10.2.2 Ways of reducing the use of resources

Question 03 · continued

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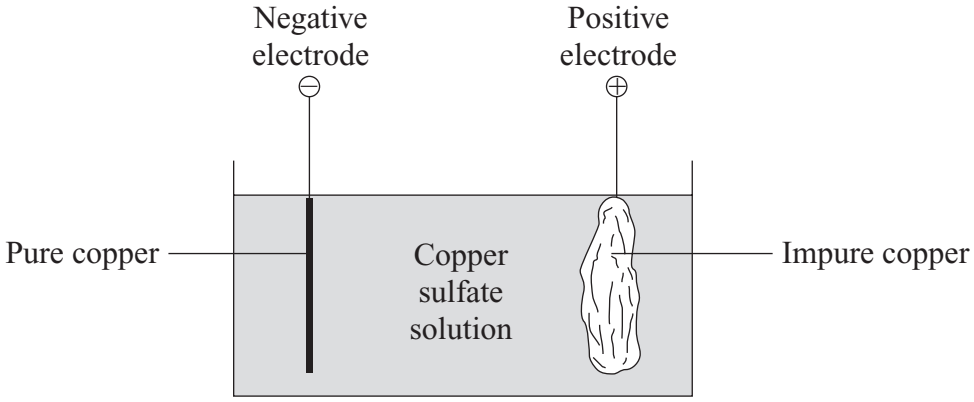
(c) During the third stage the copper can be purified as shown in the diagram.



(i) What is the name of the type of process used for this purification?

.....

(1 mark)

(ii) Give **one** use of purified copper.

.....

(1 mark)

(d) Copper-rich ores are running out.

New ways of extracting copper from low grade ores are being researched.

Recycling of copper may be better than extracting copper from its ores.

Explain why.

.....

.....

.....

.....

.....

.....

(3 marks)

10

4.10.2.2 Ways of reducing the use of resources

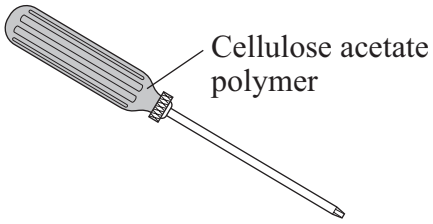
Question 04

November 2007 | CHY1B | Original Q2 | Legacy

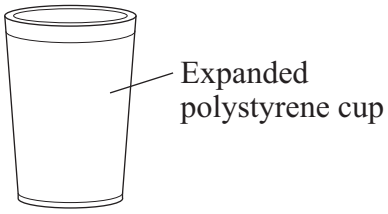
QUESTION TWO

This question is about the properties of polymers and their uses.

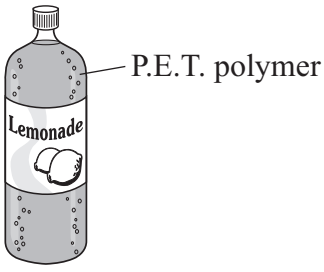
The drawings show four different objects. Each is made using a different polymer.



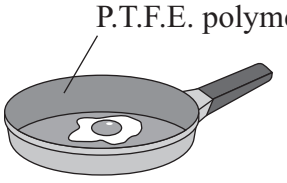
A Screwdriver



B Disposable coffee cup



C Bottle for soft drinks



D Frying pan

The table below shows some properties of four different polymers.

Match the polymers used in objects, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

	Properties of the polymer
1	It forms a non-stick surface that can be strongly heated.
2	It is strong but light, transparent and can be recycled.
3	It is strong, rigid and a good electrical insulator.
4	It is a good heat insulator, very light and cheap to make.

4.10.2.2 Ways of reducing the use of resources

Question 05

November 2007 | CHY1B | Original Q8 | Legacy

QUESTION EIGHT

Plastic waste in the United Kingdom has reached 3 million tonnes per year.
About 56% of this waste is from packaging.
60% of the litter on United Kingdom beaches is plastic.
Under European law, at least 55% of packaging must be recycled by 2008.

Most plastic waste does not break down at all.
Three improved types of plastic used for bags and packaging are:

- degradable – breaks down over a long period of time, but only into smaller pieces
- biodegradable – undergoes decomposition by microorganisms; produces some solid waste which may be toxic
- compostable – biodegrades and disintegrates in a compost-making system at home; produces no toxic waste

8A One reason that plastics are often used for bags and packaging is that they are cheap to produce.

Which of these properties of plastics is the **least** important when they are used for making waste-bin liners?

1 lightweight

2 resist wear and tear

3 resist chemicals and water

4 transparent

8B Which of these is **not** an advantage of recycling plastics?

1 conservation of non-renewable fuels

2 reduced energy consumption

3 less waste to landfill

4 reduced use of plastic bags

4.10.2.2 Ways of reducing the use of resources

Question 05 · continued

8C A supermarket chain has introduced compostable food containers. Which of the following may **not** happen because of the increased use of compost-making systems at home?

1 It will save council transport and labour costs.

2 It will save space in landfill sites.

3 It will reduce costs to supermarkets.

4 It will help to conserve non-renewable fuels.

8D Some supermarkets are using more environmentally-friendly packaging.

The most likely commercial reason for this is that the supermarkets are concerned about . . .

1 decreasing the amount of litter.

2 the damaging effects of acid rain.

3 the increasing cost of plastics.

4 attracting more customers.

4.10.2.2 Ways of reducing the use of resources

Question 06

8 Soda-lime glass is made by heating, to above 1500 °C, a mixture of:

soda (sodium carbonate), Na_2CO_3

limestone (calcium carbonate), $CaCO_3$

sand (silicon dioxide), SiO_2

(a) (i) Which element do all of these compounds contain?

.....

(1 mark)

(ii) Explain what the formula Na_2CO_3 shows about the compound.

.....

.....

.....

.....

(2 marks)

(b) Calcium carbonate breaks down when heated to above 1500 °C.

(i) Write a word equation to show what happens.

..... → ..... + ...

(2 marks)

(ii) What is the name of this type of chemical reaction?

.....

(1 mark)

(c) The melting point of soda-lime glass is about 750 °C.
The raw materials for making soda are limestone and common salt (sodium chloride).
There are almost unlimited amounts of the raw materials available to manufacture soda-lime glass.

From the information given, what is the most important reason for recycling soda-lime glass?

.....

.....

(1 mark)

7

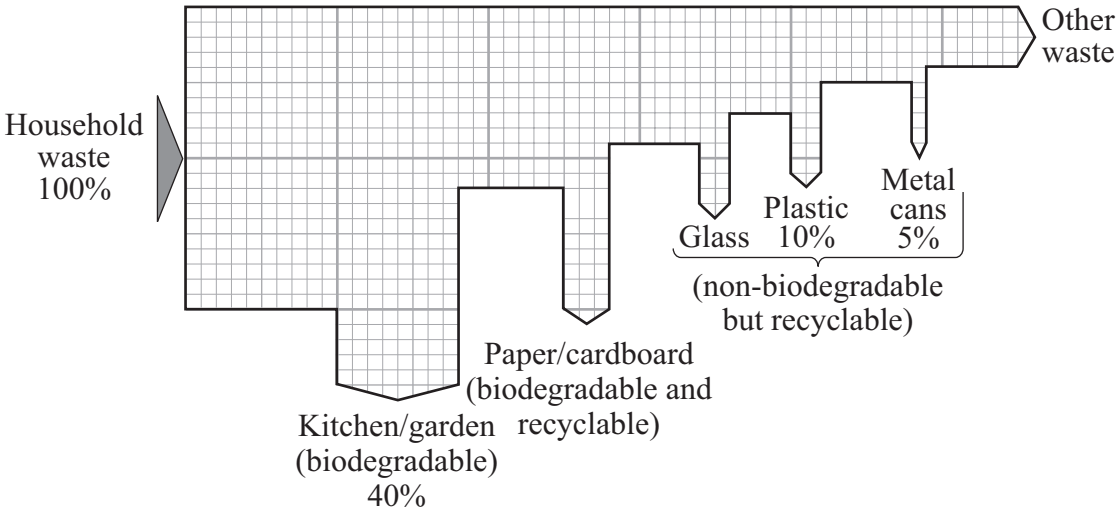
4.10.2.2 Ways of reducing the use of resources

Question 07

March 2008 | CHY1BP | Original Q3 | Legacy

QUESTION THREE

The Sankey diagram shows the composition of typical household waste.



Match percentages (%), **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A 10%

B 15%

C 20%

D 55%

	Percentage (%)
1	the percentage of waste that is glass
2	the percentage of waste that is paper and cardboard
3	the percentage of waste that is **not** biodegradable or recyclable
4	the percentage of waste that is biodegradable

4.10.2.2 Ways of reducing the use of resources

Question 08

June 2008 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

- Iron is obtained by reducing its oxide ore with carbon.
- Aluminium **cannot** be obtained by reducing its oxide ore with carbon.
- Gold occurs as the metal itself.

8A From the information above, which row in the table shows the order of reactivity of the four elements?

	most reactive →			**least reactive**
1	aluminium	carbon	iron	gold
2	iron	aluminium	carbon	gold
3	iron	aluminium	gold	carbon
4	aluminium	iron	gold	carbon

8B Iron obtained directly from the blast furnace was used to build the Iron Bridge in Shropshire.

This bridge is unsuitable for use by modern lorries because . . .

1 it **cannot** be stopped from rusting.

2 it will easily bend out of shape.

3 it is too heavy to support its own weight.

4 it is too brittle and so it will break.

4.10.2.2 Ways of reducing the use of resources

Question 08 · continued June 2008 | CHY1AP | Original Q8 | Legacy

- Aluminium waste of high purity can be recycled.
- Any iron and other impurities are removed.
- The aluminium is then melted and processed in the same way as aluminium that has been extracted from its ore.
- Recycling aluminium in this way creates only 5% of the carbon dioxide produced by extracting aluminium from its ore.

8C Which of the following benefits an aluminium recycling company financially?

1 a fall in the price of aluminium

2 the high melting point of aluminium

3 the high purity of the aluminium waste arriving at the recycling plant

4 the metal can be purified by electrolysis

8D An environmental disadvantage of recycling aluminium is that . . .

1 the aluminium waste has to be transported for recycling.

2 land fill sites would **not** be filled so quickly.

3 the process creates only 5% of the carbon dioxide produced by extracting aluminium from its ore.

4 the price of aluminium will fall.

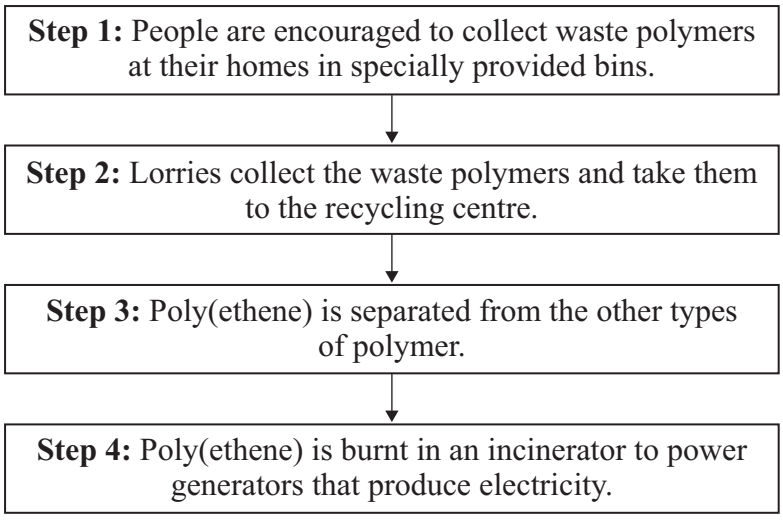
4.10.2.2 Ways of reducing the use of resources

Question 09

June 2008 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

The flow chart shows how the waste poly(ethene) from our homes can be used.



8A One problem associated with **Step 1** is that . . .

1 some people do **not** put their waste polymers in the special bins.

2 people prefer to burn their waste polymers.

3 poly(ethene) is toxic.

4 waste polymers rot and begin to smell.

8B One problem associated with **Step 2** is that . . .

1 burning diesel fuel in lorries can increase global warming.

2 people do **not** know where the recycling centres are.

3 the bins of waste polymers are very heavy.

4 the lorries are hard to recognise.

4.10.2.2 Ways of reducing the use of resources

8C One problem associated with **Step 3** is that . . .

1 all polymers are the same colour.

2 polymers **cannot** be melted down.

3 polymers are magnetic.

4 separating polymers costs money.

8D One reason why all waste polymers are **not** burned in **Step 4** is that . . .

1 burning polymers can produce toxic gases.

2 polymers are poor conductors of electricity.

3 some polymers melt before burning.

4 burning polymers produces too much heat.

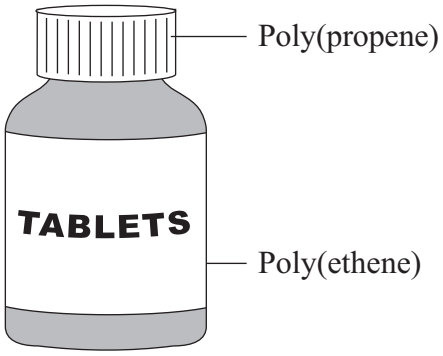
Turn over for the next question

4.10.2.2 Ways of reducing the use of resources

Question 10

June 2008 | CHY1F | Original Q5 | Legacy

5 Tablet containers are often made from two different polymers.



5 (a) Ethene, C_2H_4, and propene, C_3H_6, can be made from crude oil.

5 (a) (i) Complete the following sentence.

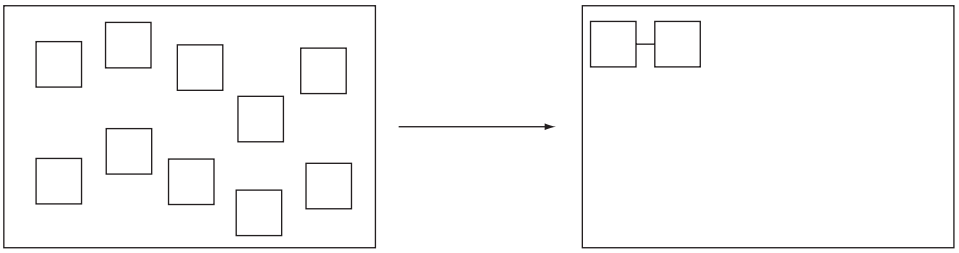
Ethene and propene are called hydrocarbons because they are made up of carbon and ..... atoms only.

(1 mark)

5 (a) (ii) Ethene molecules are used to form poly(ethene) molecules.

Complete the diagram to show the poly(ethene) molecule.

Ethene molecules **Poly(ethene) molecule**



(2 marks)

5 (b) The tablet containers could be disposed of in a landfill site or could be recycled.

5 (b) (i) Suggest **two** reasons why disposing of the tablet containers in a landfill site could cause problems.

1 .....

.....

2 .....

.....

(2 marks)

4.10.2.2 Ways of reducing the use of resources

Question 10 · continued

for mark

5 (b) (ii) Suggest **one** reason why recycling the tablet containers would be difficult.

.....

.....

(1 mark)

6

Turn over for the next question

4.10.2.2 Ways of reducing the use of resources

Question 11

June 2008 | CHY1F | Original Q7 | Legacy

7 Limestone is mainly calcium carbonate.

7 (a) Quicklime is produced by heating limestone.

7 (a) (i) Complete the word equation for this reaction by writing the chemical name of the solid and the gas produced.

calcium carbonate → ..... + ...

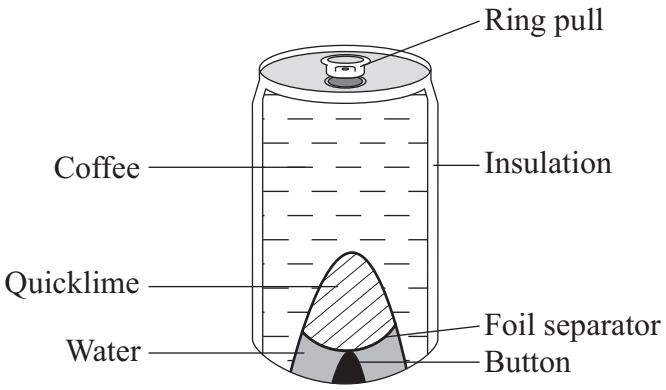
(2 marks)

7 (a) (ii) What is the name for this type of chemical reaction?

.....

(1 mark)

7 (b) Quicklime is used in self-heating cans.
The diagram shows a self-heating can designed to raise the temperature of coffee to 60 °C.



The button on the base of the can is pushed. The foil separator breaks, allowing water to mix with the quicklime. After about 3 minutes, the can is opened by the ring pull. Insulating materials are used inside the walls of the can to prevent either the lips or the fingers from being burned.

7 (b) (i) Explain why the coffee becomes hot.

.....

.....

.....

.....

(2 marks)

4.10.2.2 Ways of reducing the use of resources

Question 11 · continued

for mark

7 (b) (ii) Suggest **two** reasons why it is **not** possible to re-use this self-heating can.

1 .....

.....

2 .....

.....

(2 marks)

7

Turn over for the next question

4.10.2.2 Ways of reducing the use of resources

Question 12

November 2008 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about copper and its alloys.

Match descriptions, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A a mixture

B expensive to extract from its ore

C a good conductor

D hard-wearing

It is worth recycling copper because it is . . . **1** . . . .

Copper is difficult to separate from an alloy because the alloy is . . . **2** . . . .

Bronze (a copper alloy), has been used for hundreds of years for making coins because it is . . . **3** . . . .

Copper is used for electrical wiring because it is . . . **4** . . . .

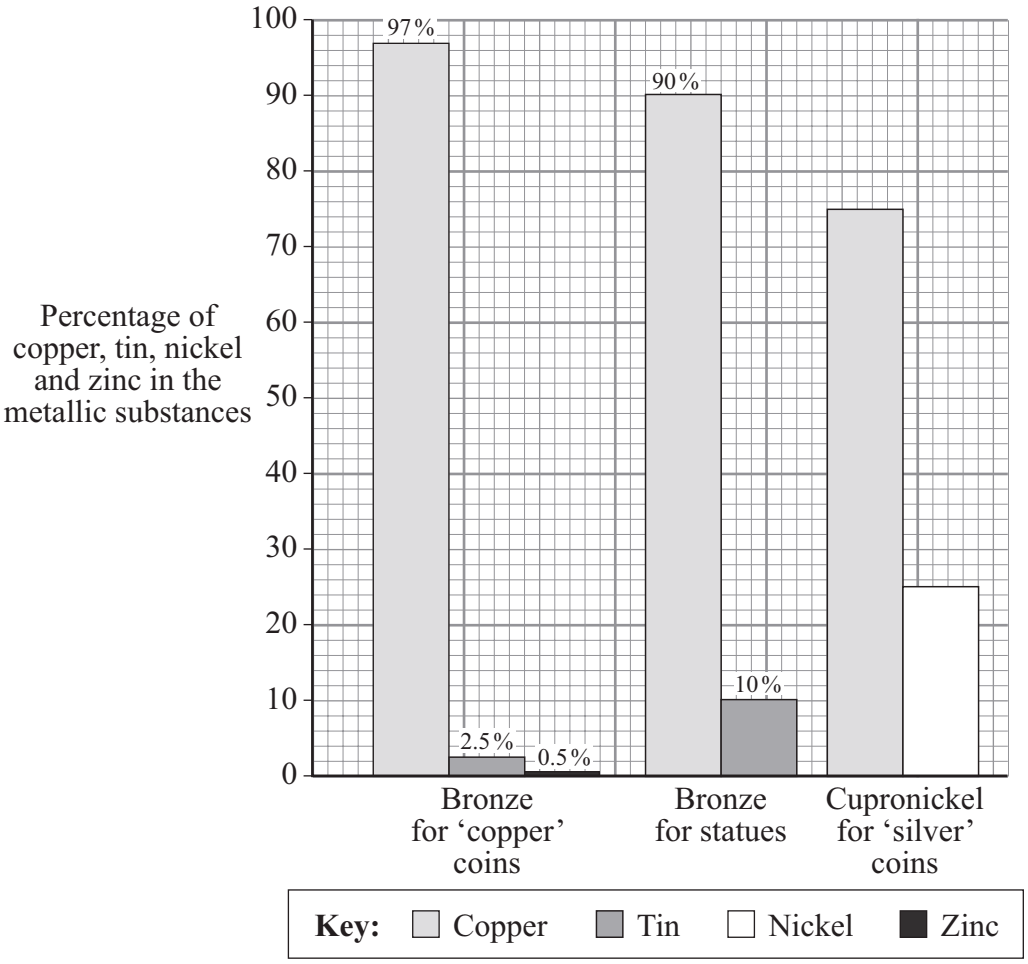
4.10.2.2 Ways of reducing the use of resources

Question 13

November 2008 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

The bar chart shows the composition of three metallic substances.



6A Bronze and cupronickel are examples of . . .

1 compounds.

2 alloys.

3 elements.

4 ores.

4.10.2.2 Ways of reducing the use of resources

Question 13 · continued

6B ‘Silver’ coins are made from cupronickel.

What percentage of nickel do these coins contain?

1 10 %

2 15 %

3 25 %

4 75 %

6C Compared with bronze for ‘copper’ coins, the bronze used for statues contains . . .

1 a higher ratio of copper to tin.

2 four times as much tin.

3 less tin per 100 g of mixture.

4 more metal elements.

6D The most likely reason for recycling bronze is . . .

1 to conserve ore deposits.

2 to reclaim zinc.

3 that bronze statues are no longer made.

4 that the price of bronze has fallen.

4.10.2.2 Ways of reducing the use of resources

Question 14

November 2008 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

The extraction of iron involves heating a mixture of iron ore, limestone and coke (carbon) at high temperatures in a blast furnace.

The limestone and iron ore are extracted from large quarries, some of which are found in areas of outstanding natural beauty.

9A Some people are against the development of these large quarries.

One reason is that the quarries . . .

1 attract large numbers of tourists to visit the area.

2 make unsightly scars on the landscape.

3 are unnecessary because there are few uses for limestone.

4 create a dangerous habitat for wildlife.

9B Some people support the development of these quarries.

One reason is that the working quarries . . .

1 are always placed where the public cannot see them.

2 conserve resources.

3 provide employment for people who live in the area.

4 provide an area for leisure activities.

9C Iron is produced continuously, sometimes for several years without shutting down the blast furnace.

This is done . . .

1 because it is difficult to obtain large supplies of limestone.

2 because it takes several years to reach the required temperature in the furnace.

3 to minimise the energy costs.

4 to ensure that the iron is of the highest quality.

4.10.2.2 Ways of reducing the use of resources

Question 14 · continued

9D Some iron is obtained by recycling scrap iron.

Why does it take less energy to make iron from scrap iron than to extract the iron from its ore?

1 Scrap iron is an alloy.

2 Scrap iron contains the element sulfur.

3 Scrap iron does **not** have to be reduced using carbon.

4 Corrosion of the scrap iron makes it easier to melt.

END OF TEST

4.10.2.2 Ways of reducing the use of resources

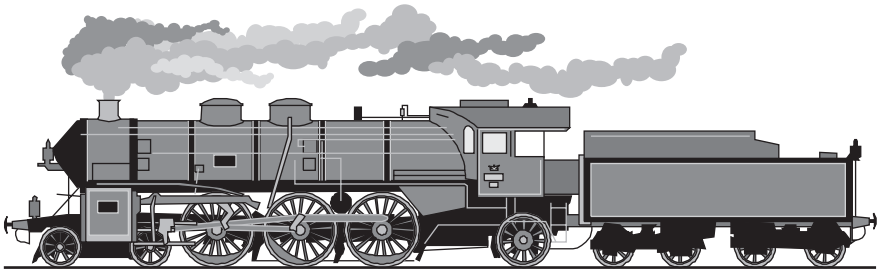
Question 15

June 2009 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Read the following newspaper extract.

Copper shortage puts the brakes on Flying Scotsman renovation



A major overhaul of the steam locomotive Flying Scotsman has been delayed by more than a year because of the lack of copper for the engine's firebox.

Copper is at a record high price because of huge demand from China's rapidly growing economy. The price had been falling over the previous 30 years, which had discouraged exploration for new supplies.

Other users have been forced to switch to cheaper materials, with plumbers using plastic rather than copper pipes, and telecoms firms using fibre-optic cables rather than copper wire.

9A The firebox of a steam locomotive is where coal is burned to boil water.

Which of these properties is **not** important when using copper in the firebox of a steam locomotive?

1 Copper is a good conductor of heat.

2 Copper has a high melting point.

3 Copper is a good conductor of electricity.

4 Copper is easily hammered and bent into shape.

Question 15 · continued

9B Which row in the table explains why copper was important to plumbers and telecoms firms?

	Plumbers	Telecoms firms
1	High melting point	Good heat conductor
2	Good electrical conductor	High melting point
3	Resistant to corrosion	Good electrical conductor
4	High boiling point	Good electrical conductor

9C Which of the following would make the copper shortage in China and other countries worse?

1 recycling scrap copper rather than burying it in landfill sites

2 developing alternative materials to do the same job as copper

3 extraction of copper from low-grade ores

4 forcing suppliers to reduce the price of copper

9D Why is it environmentally important to recycle copper rather than mine fresh copper ore?

1 Copper ores are non-renewable, and a lot of energy is needed to extract copper from its ore.

2 There are enormous reserves of copper ore which are not expected to run out for hundreds of years.

3 Copper ores are cheap, and scrap copper is easy to dispose of in landfill sites.

4 Copper recycling is difficult and uses more energy when compared with processing new ores.

END OF TEST

4.10.2.2 Ways of reducing the use of resources

Question 16

June 2009 | CHY1BP | Original Q2 | Legacy

QUESTION TWO

The table shows the properties of four polymers **A**, **B**, **C** and **D**.

	Polymer	Properties
A	PTFE	can withstand high temperatures and is non-stick
B	Nylon	strong, does not rot and can be pulled into fibres
C	Polystyrene	makes a very light, solid foam which is a good heat insulator
D	PET	strong, light, waterproof and can be recycled

Match polymers, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

	How the polymer could be used
1	to make disposable cups for hot drinks
2	to make the coating on frying pans
3	to make string and ropes
4	to make bottles for soft drinks

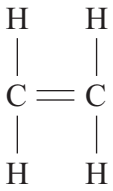
4.10.2.2 Ways of reducing the use of resources

Question 17

June 2009 | CHY1F | Original Q5 | Legacy

5 Crude oil is used to make useful substances such as alkenes and plastics.

5 (a) The alkene shown is ethene.



5 (a) (i) Tick (✓) the correct formula for ethene.

Formula	(✓)
CH_4	
C_2H_4	
C_2H_6	

(1 mark)

5 (a) (ii) Tick (✓) the name of the plastic formed when many ethene molecules join together.

Name of plastic	(✓)
Poly(ethene)	
Poly(ethanol)	
Poly(propene)	

(1 mark)

4.10.2.2 Ways of reducing the use of resources

Question 17 · continued

for mark

5 (b) Read the article about plastics and then answer the questions.

THE PROBLEM WITH PLASTIC WASTE

The UK produces about 3 million tonnes of plastics from crude oil every year.
Most of the litter found on UK beaches is plastic waste.
80% of the plastics produced end up in landfill sites.
The UK recycles only 7% of plastic waste.

5 (b) (i) Draw a ring around the correct answer in the box to complete the sentence.

Litter that is plastic waste needs to be removed from beaches

because it

- decomposes.
- is flammable.
- is not biodegradable.

(1 mark)

5 (b) (ii) Suggest a problem caused by 80% of the plastics going to landfill sites.

.....

.....

(1 mark)

5 (b) (iii) The UK government has set a target to recycle 30% of plastic waste.

How are resources saved by recycling more plastics?

.....

.....

(1 mark)

5

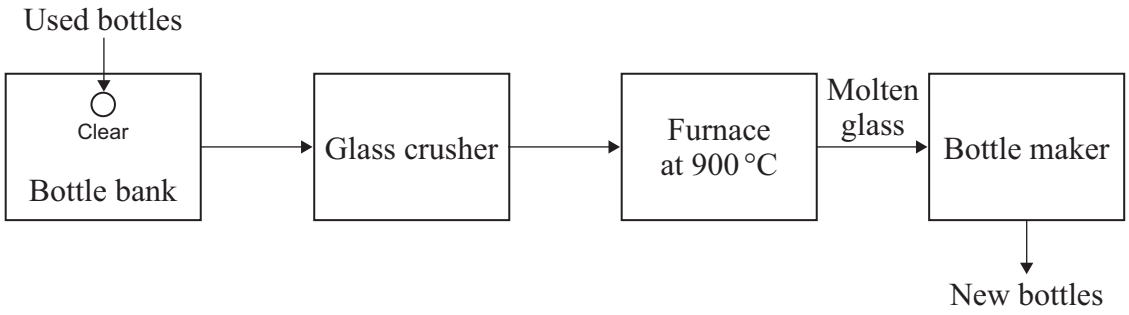
4.10.2.2 Ways of reducing the use of resources

Question 18

January 2010 | CHY1F | Original Q7 | Legacy

7 In recent years we have become more aware of the need to recycle glass.

7 (a) Used glass bottles can be recycled if they are put into bottle banks.



7 (a) (i) Suggest **one** reason why light bulbs should **not** be put into bottle banks.

.....

.....

(1 mark)

7 (a) (ii) Very few glass bottles are reused (used more than once).

Suggest **one** reason why.

.....

.....

(1 mark)

7 (a) (iii) New glass bottles can also be produced by heating, at 1700 °C, a mixture of the following raw materials:

sand (silicon dioxide), SiO_2
soda ash (sodium carbonate), Na_2CO_3
limestone (calcium carbonate), $CaCO_3$

Explain why the use of recycled glass to make glass bottles produces less carbon dioxide than making glass bottles from these raw materials.

.....

.....

.....

.....

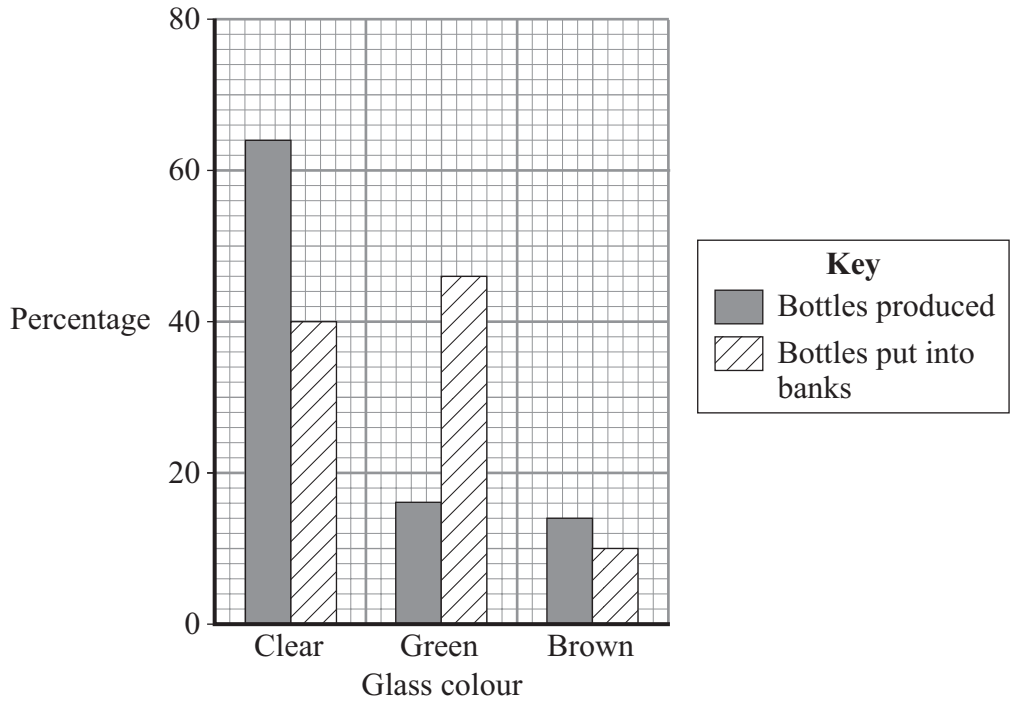
(2 marks)

4.10.2.2 Ways of reducing the use of resources

Question 18 · continued

for mark

7 (b) The bar chart shows the percentages of glass bottles produced and the percentages of glass bottles put into bottle banks in the UK.



7 (b) (i) The percentage of green glass bottles produced is 16%.
What is the percentage of green glass bottles put into bottle banks?

Percentage = ... %

(1 mark)

7 (b) (ii) More green glass bottles are put into bottle banks than are made in the UK.
Suggest **one** reason why.

.....

.....

(1 mark)

7 (b) (iii) Suggest and explain **one** problem resulting from the percentage of clear glass bottles produced in the UK.

.....

.....

.....

.....

(2 marks)

8

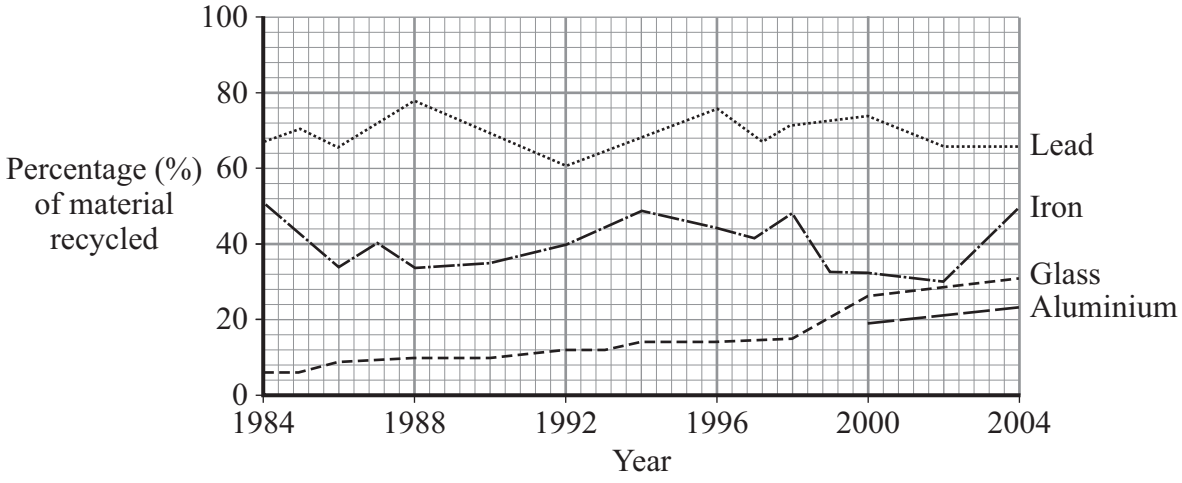
4.10.2.2 Ways of reducing the use of resources

Question 19

March 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

The graph shows the percentages of aluminium, glass, iron and lead that have been recycled in the UK between 1984 and 2004.



Match materials, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A aluminium

B glass

C iron

D lead

The material that has the highest percentage recycled is . . . **1** . . . .

Before 2000, there is no data for . . . **2** . . . .

Since 1984, there has been an increase in the percentage of . . . **3** . . . recycled.

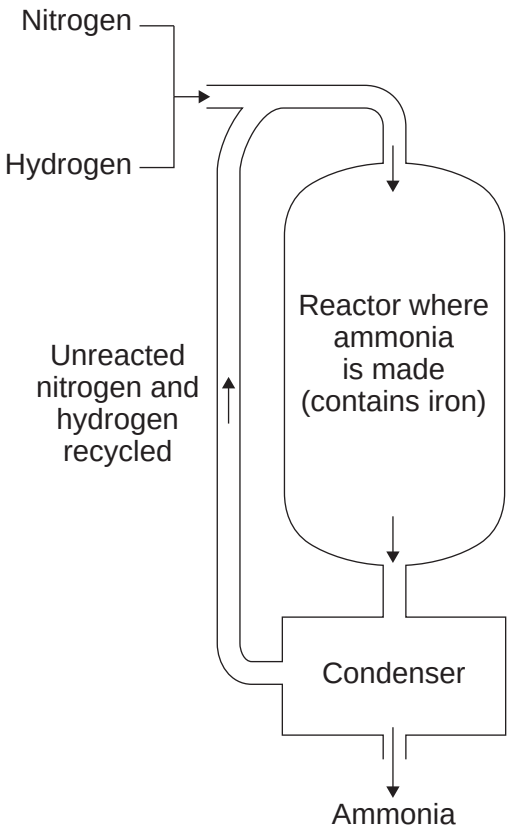
Since 2002, there has been a steep increase in the percentage of . . . **4** . . . recycled.

4.10.2.2 Ways of reducing the use of resources

Question 20

June 2010 | CHY2F | Original Q6 | Legacy

6 (a) The diagram shows how ammonia is made.



6 (a) (i) Complete the word equation for the reaction that takes place in the reactor.

nitrogen + ... → .....

(1 mark)

6 (a) (ii) Ammonia is made by passing nitrogen and hydrogen over hot iron.
Why is iron used in the reactor?

.....

.....

(1 mark)

6 (a) (iii) Explain how ammonia is separated from the unreacted nitrogen and hydrogen.

.....

.....

.....

.....

(2 marks)

4.10.2.2 Ways of reducing the use of resources

Question 20 · continued

6 (b) Ammonia is used to make the fertiliser ammonium nitrate.

Calculate the relative formula mass (M_r) of ammonium nitrate, NH_4NO_3

Relative atomic masses (A_r): H = 1; N = 14; O = 16

.....

.....

.....

.....

Relative formula mass = ...

(2 marks)

6 (c) Another fertiliser is potassium nitrate, KNO_3

The relative formula mass (M_r) of potassium nitrate is 101.

Relative atomic masses (A_r): N = 14; O = 16; K = 39

The table shows the percentage by mass of potassium and nitrogen in four fertilisers, **A**, **B**, **C** and **D**.

Fertiliser	Percentage by mass of potassium (%)	Percentage by mass of nitrogen (%)
A	12.45	25.21
B	19.91	24.12
C	38.61	13.86
D	24.89	9.25

Which fertiliser, **A**, **B**, **C** or **D**, is potassium nitrate?

You **must** show your working to gain full marks.

.....

.....

.....

.....

Potassium nitrate is fertiliser ☐

(2 marks)

8

4.10.2.2 Ways of reducing the use of resources

Question 21

November 2010 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Aluminium is extracted from a substance called bauxite. Bauxite contains aluminium oxide and impurities such as sand. Bauxite is first purified to make pure aluminium oxide. Then electricity is passed through the molten aluminium oxide. The molten aluminium oxide splits to make aluminium and oxygen.

9A Bauxite is an example of . . .

1 an element.

2 a compound.

3 an ore.

4 a solution.

9B The process used to extract aluminium is . . .

1 thermal decomposition.

2 reduction.

3 corrosion.

4 distillation.

9C Aluminium **cannot** be extracted from aluminium oxide using carbon because . . .

1 aluminium is more reactive than carbon.

2 the density of aluminium is too low.

3 carbon is higher in the reactivity series than aluminium.

4 aluminium is covered in a layer of aluminium oxide.

9D Aluminium is often recycled.

Which one of the following is **not** a good reason to recycle aluminium?

1 Recycling is cheaper than extracting aluminium from bauxite.

2 Drinks cans must be made from aluminium.

3 Recycling reduces the amount of energy used to make aluminium.

4 Bauxite reserves will last longer.

END OF TEST

4.10.2.2 Ways of reducing the use of resources

Question 22

January 2011 | CHY1F | Original Q6 | Legacy

6 The flow diagram shows the main stages used to extract a metal from its ore.

mining the ore → purifying the ore → extracting the metal

The table shows some information about three metals.

Metal	Metal ore	Purified ore	% of metal in the ore	% of metal in the Earth's crust
aluminium	bauxite	aluminium oxide, Al_2O_3	28.0	8.0
copper	chalcocite	copper sulfide, Cu_2S	0.5	0.001
iron	haematite	iron oxide, Fe_2O_3	29.0	5.0

6 (a) Use the information in the table and your knowledge and understanding to help you to answer the questions.

6 (a) (i) Suggest why purifying the copper ore produces large quantities of waste.

.....

.....

.....

(1 mark)

6 (a) (ii) Suggest why the annual world production of iron is forty times greater than that of aluminium.

.....

.....

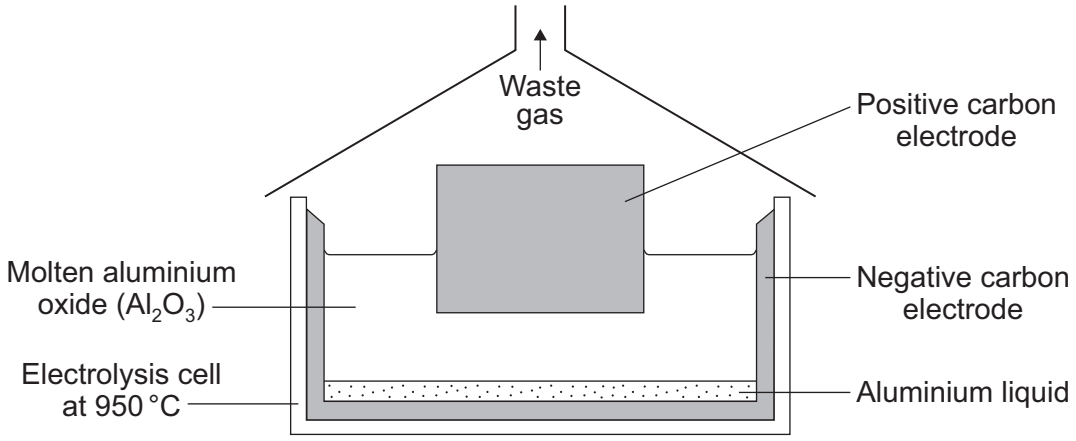
.....

(1 mark)

4.10.2.2 Ways of reducing the use of resources

Question 22 · continued

6 (b) Aluminium is used for drinks cans.
Aluminium is extracted from its purified ore by electrolysis.



6 (b) (i) Suggest why the aluminium produced in the electrolysis cell is a liquid.

.....

.....

(1 mark)

6 (b) (ii) In this electrolysis, aluminium and oxygen gas are produced from the aluminium oxide.

Use the information in the diagram to suggest why most of the waste gas is carbon dioxide and not oxygen.

.....

.....

.....

.....

(2 marks)

6 (b) (iii) Aluminium is the most abundant metal in the Earth's crust.

Suggest **two** reasons why we should recycle aluminium drinks cans.

1 .....

.....

2 .....

.....

(2 marks)

7

4.10.2.2 Ways of reducing the use of resources

Question 23

March 2011 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

This question is about the extraction and recycling of copper.

Copper is used in its pure form or mixed with other metals.
Large amounts of scrap copper metal from a variety of sources can easily be recycled by re-melting.

9A Pure copper can be extracted directly by . . .

1 thermal decomposition of copper carbonate.

2 thermal decomposition of copper oxide.

3 carbon reduction of copper oxide in a blast furnace.

4 electrolysis of copper compounds dissolved in water.

9B Small amounts of other metals are sometimes added to copper to produce . . .

1 compounds that conduct electricity better.

2 compounds that are softer.

3 alloys that are harder.

4 new elements that are harder.

9C The price of copper would increase if there was . . .

1 a decrease in the demand for copper.

2 an increase in energy costs.

3 an increase in the amount of copper being recycled.

4 a discovery of a low grade copper ore in a remote area of the world.

9D One **disadvantage** of recycling copper is that it . . .

1 prevents heaps of scrap metal from building up.

2 still requires the use of energy resources.

3 will increase the price of copper.

4 will contaminate the world's supplies of copper.

END OF TEST

4.10.2.2 Ways of reducing the use of resources

Question 24

November 2011 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Iron oxide can be reduced to iron by mixing the oxide with carbon and heating strongly.

Aluminium oxide cannot be reduced to aluminium in this way. Aluminium is obtained from aluminium oxide by electrolysis.

9A Why is it possible to obtain iron but not aluminium by carbon reduction?

1 Iron is more reactive than aluminium.

2 Carbon is more reactive than aluminium but less reactive than iron.

3 Carbon is more reactive than iron but less reactive than aluminium.

4 Aluminium and iron are both more reactive than carbon.

9B The extraction of aluminium by electrolysis is an expensive process because . . .

1 aluminium easily corrodes in air.

2 a large amount of energy is needed.

3 aluminium oxide is difficult to mine.

4 aluminium reacts with carbon.

9C As electrolysis is expensive, an increasing amount of aluminium is being recycled.

Another important reason to recycle aluminium is that . . .

1 it saves limited aluminium oxide reserves.

2 the recycled aluminium is purer.

3 aluminium scrap does not corrode easily.

4 recycling aluminium does not use energy.

4.10.2.2 Ways of reducing the use of resources

Question 24 · continued

9D Which two of the following statements could explain why aluminium is preferred to iron for making cans for drinks?

W Aluminium has a lower density than iron.

X Aluminium is a better conductor than iron.

Y Aluminium corrodes less easily than iron.

Z Aluminium is not as strong as iron.

1 **W** and **X**

2 **W** and **Y**

3 **X** and **Y**

4 **Y** and **Z**

END OF TEST

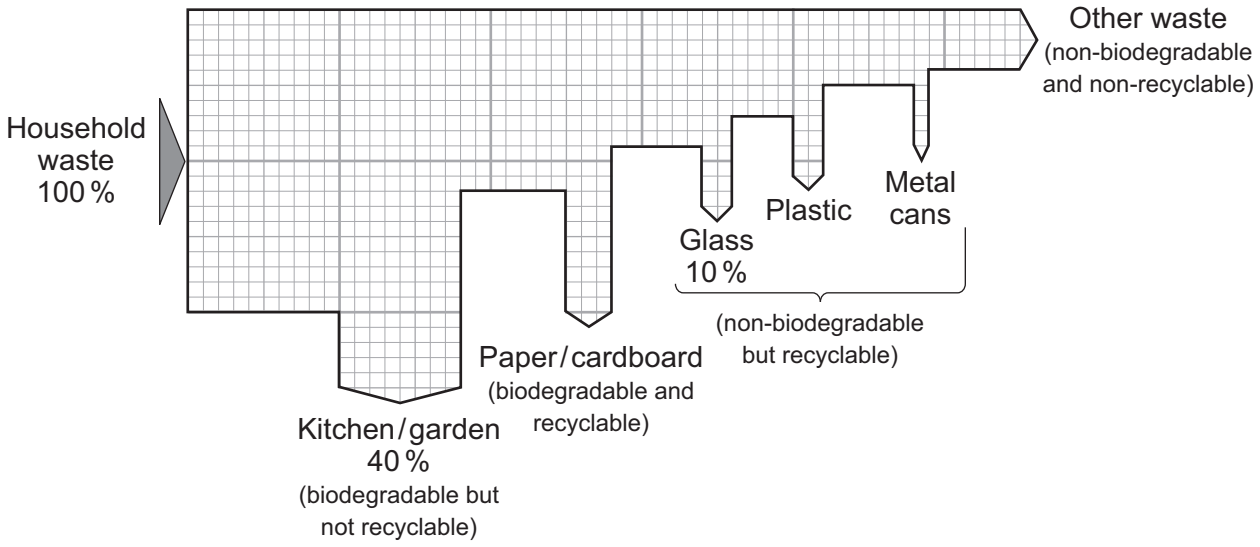
4.10.2.2 Ways of reducing the use of resources

Question 25

November 2011 | CHY1BP | Original Q4 | Legacy

QUESTION FOUR

The diagram shows the composition of typical household waste.



Match percentages (%), **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A 5 %

B 10 %

C 40 %

D 55 %

	Percentage (%)
1	the percentage of waste that is plastic
2	the percentage of waste that is metal
3	the percentage of waste that is recyclable
4	the percentage of waste that is biodegradable

4.10.2.2 Ways of reducing the use of resources

Question 26

November 2011 | CHY1BP | Original Q7 | Legacy

QUESTION SEVEN

Scientists working for a plastics company tested three different types of poly(ethene) to see how much they would stretch before tearing.

7A The scientists used identical apparatus, equal-sized pieces of poly(ethene), and carried out all the tests at the same temperature.

They did this so that . . .

1 all the variables were kept the same.

2 it was easier and cheaper to carry out the tests.

3 all the measurements would be accurate.

4 only the independent variable would affect the results.

7B Cling film, a very thin sheet of poly(ethene), is used to wrap sandwiches.

Which row in the table shows two properties of poly(ethene) that make it suitable for use as cling film?

	Property 1	Property 2
1	tears when stretched	is easily coloured and printed
2	is easily coloured and printed	is transparent
3	is transparent	is airtight
4	is airtight	easily melts when heated

7C Sandwiches could be wrapped in paper and packed in paper bags.

Paper is made from wood. When a tree is cut down, another tree can be planted to replace it.

An advantage of using paper instead of cling film is that . . .

1 the use of paper bags is sustainable.

2 paper is non-biodegradable.

3 paper has been used for hundreds of years.

4 paper does not blow about in the wind like plastic.

4.10.2.2 Ways of reducing the use of resources

7D Poly(ethene) can be recycled.

A problem that has to be overcome at the recycling centre is that poly(ethene) . . .

1 is mixed with other polymers.

2 is difficult to melt down.

3 is a poor conductor of electricity.

4 is not biodegradable.

Turn over for the next question

4.10.2.2 Ways of reducing the use of resources

Question 27

January 2012 | CH1FP | Original Q2 | Legacy

2 Cans for food and drinks are made from steel or aluminium.
The main metal in steel is iron.

2 (a) Reacting iron oxide with carbon produces iron.

Draw a ring around the correct answer to complete the sentence.

The reaction to produce iron from iron oxide is

- decomposition.
- oxidation.
- reduction.

(1 mark)

2 (b) Aluminium cannot be produced by reacting aluminium oxide with carbon.

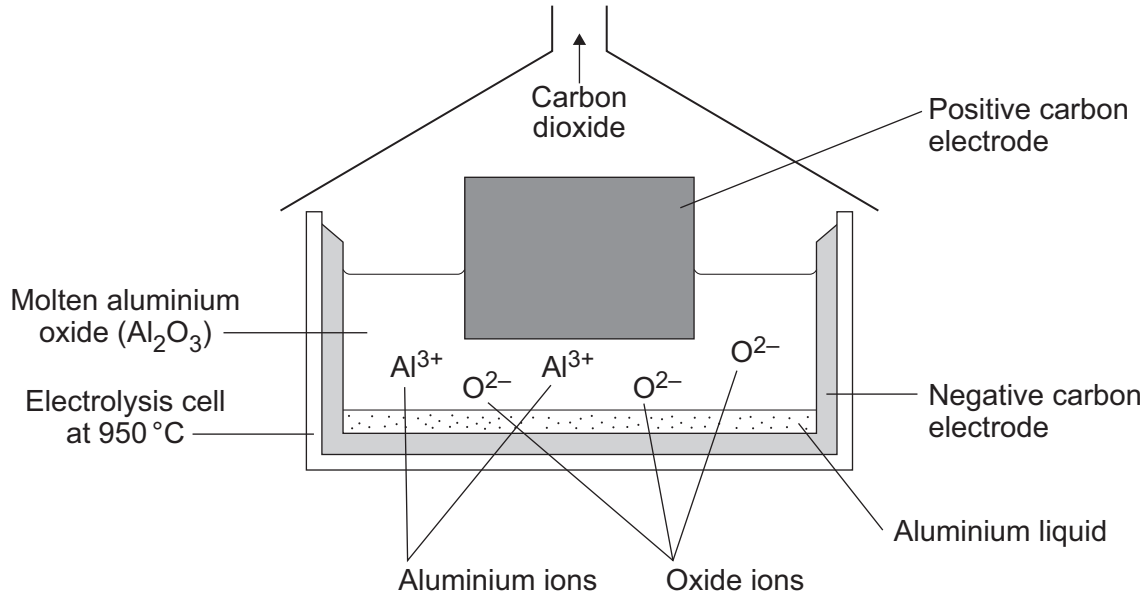
Why does aluminium oxide **not** react with carbon?

Tick (✓) the correct answer.

Answer	Tick (✓)
aluminium is less reactive than carbon	
carbon is less reactive than aluminium	
oxygen is more reactive than carbon	

(1 mark)

2 (c) Aluminium can be produced by electrolysis.



4.10.2.2 Ways of reducing the use of resources

Question 27 · continued

Why do the aluminium ions collect at the negative electrode?

.....

.....

.....

.....

(2 marks)

2 (d) Some statements about aluminium are given below.

Tick (✓) **two** statements that are correct reasons why aluminium is used to make cans.

Statement	Tick (✓)
aluminium conducts electricity	
aluminium is not a transition metal	
aluminium has a low density	
aluminium is resistant to corrosion	

(2 marks)

2 (e) Recycling aluminium cans uses less fossil fuels than producing aluminium from its ore.

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of recycling aluminium to make aluminium cans.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
aluminium is the most common metal in the Earth's crust		
less carbon dioxide is produced		
more aluminium ore needs to be mined		
used aluminium cans have to be collected and transported		

(2 marks)

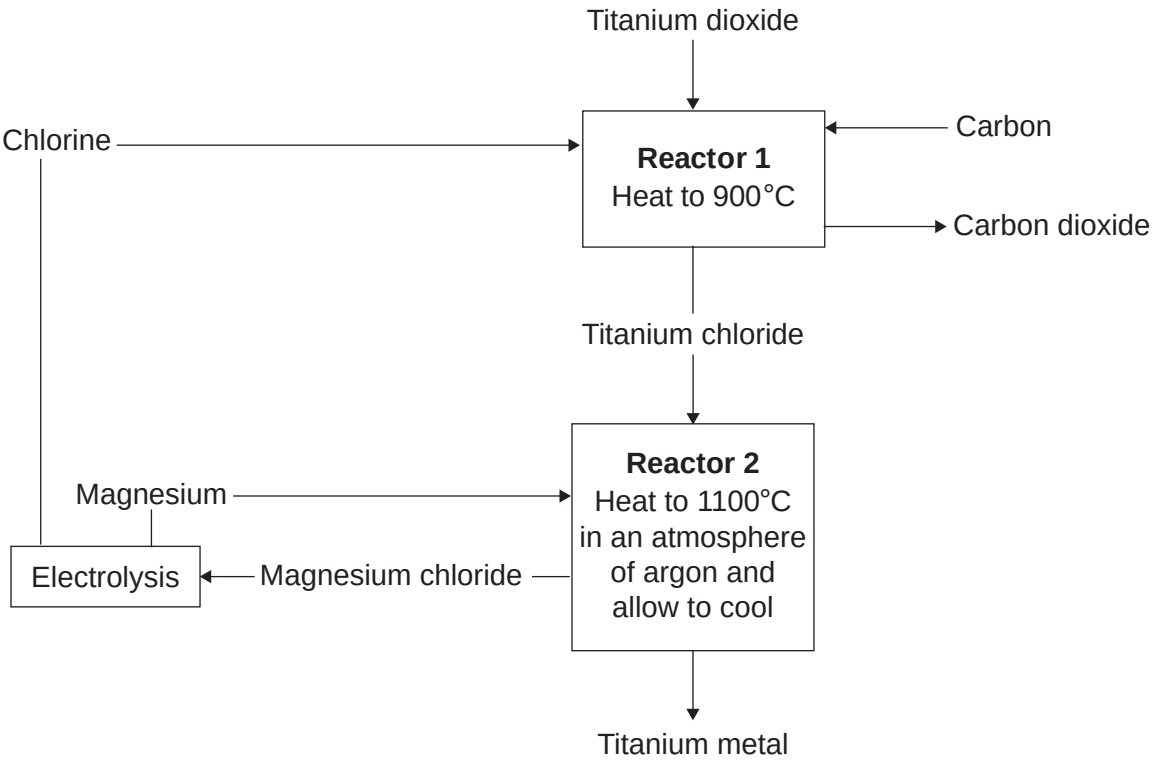
8

4.10.2.2 Ways of reducing the use of resources

Question 28

June 2012 | CH1FP | Original Q7 | Legacy

7 Rutile is an ore of titanium. Rutile contains titanium dioxide.
The flow chart shows how titanium metal is extracted from titanium dioxide.



7 (a) Titanium is much more expensive than iron.

Give **one** reason why.

.....

.....

(1 mark)

7 (b) Name the only waste product shown on the flow chart.

.....

(1 mark)

4.10.2.2 Ways of reducing the use of resources

Question 28 · continued

7 (c) Describe the example of recycling shown on the flow chart.

.....

.....

.....

.....

(2 marks)

7 (d) The air is removed from **Reactor 2**. An atmosphere of argon is used for the reaction between titanium chloride and magnesium metal.

Explain why.

.....

.....

.....

.....

(2 marks)

Question 7 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 28 · continued

7 (e) Titanium metal is produced by reacting titanium chloride with magnesium.

950 kg of titanium chloride was mixed with 240 kg of magnesium metal. The mixture was heated and produced 950 kg of magnesium chloride.

Calculate the mass of titanium metal produced.

.....

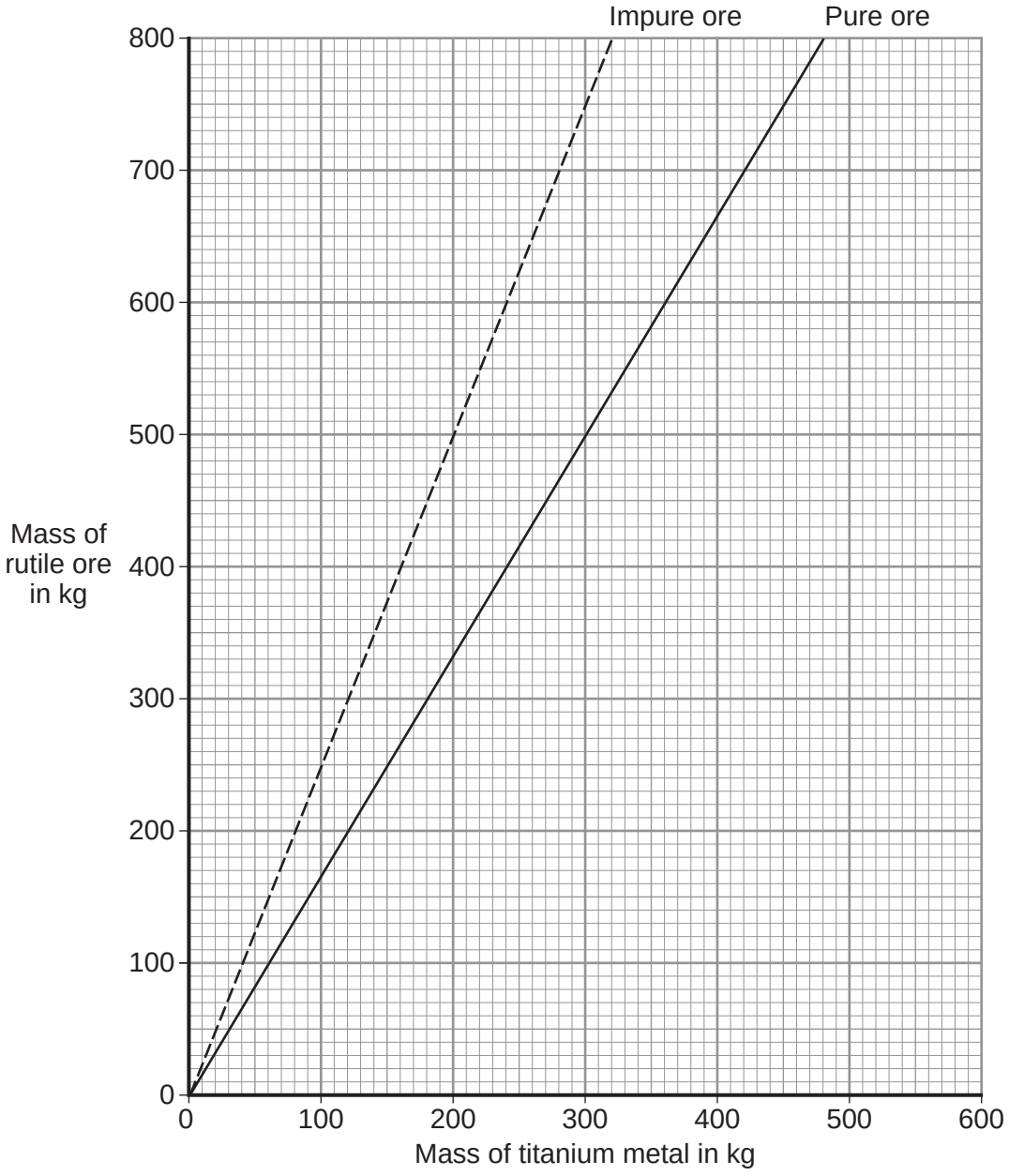
Mass = ... kg

(1 mark)

4.10.2.2 Ways of reducing the use of resources

Question 28 · continued

7 (f) The graph shows the mass of titanium metal produced from a pure rutile ore and from an impure rutile ore.



The difference between the two lines represents the amount of waste rock in the impure ore.

300 kg of titanium metal was produced from the impure ore.

Calculate the mass of waste rock in the impure ore.

.....

Mass = ... kg

(1 mark)

8

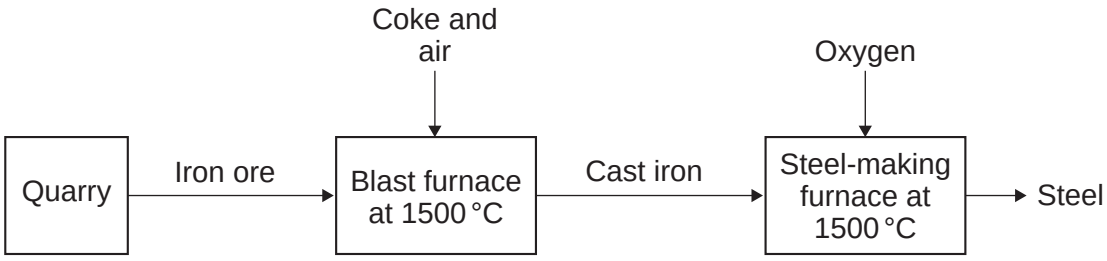
4.10.2.2 Ways of reducing the use of resources

Question 29

January 2013 | CH1FP | Original Q4 | Legacy

4 The iron produced from iron ore in a blast furnace is called cast iron.

Cast iron is converted into steel in a furnace.



Iron ore contains iron oxide.
Coke contains carbon.

4 (a) Quarrying iron ore will have an impact on everything near to the quarry.

4 (a) (i) Describe **one** positive impact and **one** negative impact of quarrying iron ore.

positive impact .....

.....

negative impact.....

.....

(2 marks)

4 (a) (ii) Draw a ring around the correct answer to complete the sentence.

Ores contain enough metal to make extraction of the metal

carbon neutral.

economical.

reversible.

(1 mark)

4 (b) Many chemical reactions take place in a blast furnace.
Use the flow diagram to help you to answer this question.

Suggest how the blast furnace is heated.

.....

.....

(1 mark)

4.10.2.2 Ways of reducing the use of resources

Question 29 · continued January 2013 | CH1FP | Original Q4 | Legacy

4 (c) A chemical reaction for the extraction of iron is:

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

4 (c) (i) Complete the word equation for this chemical reaction.

..... + carbon monoxide → iron + ...

(2 marks)

4 (c) (ii) Draw a ring around the correct answer to complete the sentence.

Iron is extracted from its ore by

- decomposition.
- oxidation.
- reduction.

(1 mark)

4 (d) Cast iron contains about 4% carbon.
Cast iron is converted into low-carbon steels.

4 (d) (i) Low-carbon steel is produced by blowing oxygen into molten cast iron.

Suggest how oxygen removes most of the carbon.

.....

.....

.....

.....

(2 marks)

4 (d) (ii) Draw a ring around the correct answer to complete the sentence.

Metals, such as nickel, are added to low-carbon steels to make the steel

- corrode easily.
- easy to shape.
- much harder.

(1 mark)

Question 4 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 29 · continued

4 (e) Recycling steel uses less energy than producing steel from iron ore**.**

Tick (✓) **one** advantage and tick (✓) **one** disadvantage of recycling steel.

Statement	Advantage Tick (✓)	Disadvantage Tick (✓)
Iron is the second most common metal in the Earth's crust.		
Less carbon dioxide is produced.		
More iron ore needs to be mined.		
There are different types of steel which must be sorted.		

(2 marks)

12

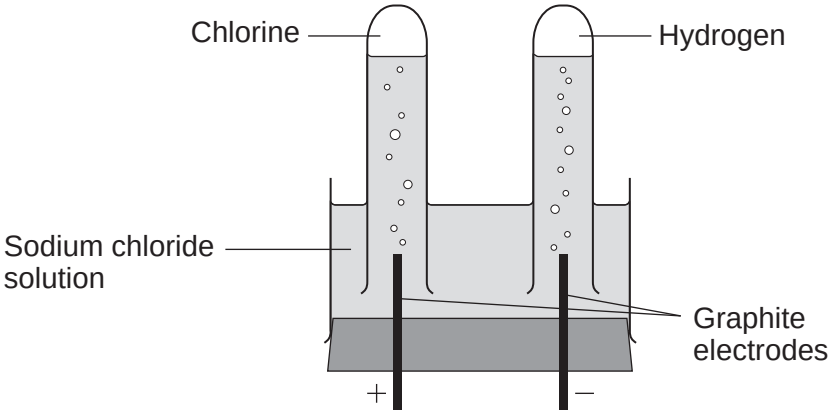
4.10.2.2 Ways of reducing the use of resources

Question 30

January 2013 | CH2FP | Original Q8 | Legacy

8 The electrolysis of sodium chloride solution is an industrial process.

The diagram shows the apparatus used in a school experiment.



8 (a) One of the products of the electrolysis of sodium chloride solution is hydrogen.

8 (a) (i) Why do hydrogen ions move to the negative electrode?

.....

.....

(1 mark)

8 (a) (ii) How does a hydrogen ion change into a hydrogen atom?

.....

.....

(1 mark)

4.10.2.2 Ways of reducing the use of resources

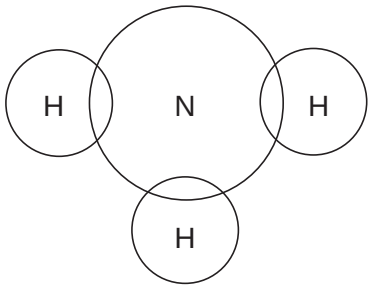
Question 30 · continued

8 (b) Hydrogen is used to make ammonia (NH_3).

Complete the diagram to show the bonding in ammonia.

Use dots (●) and crosses (x) to show electrons.

Show only outer shell electrons.



(2 marks)

8 (c) The table shows the ions in sodium chloride solution.

Positive ions	Negative ions
hydrogen	chloride
sodium	hydroxide

In industry, some of the waste from the electrolysis of sodium chloride solution is alkaline and has to be neutralised.

8 (c) (i) Which ion makes the waste alkaline?

.....

(1 mark)

8 (c) (ii) This waste must be neutralised.

Write the ionic equation for the neutralisation reaction.

.....

(1 mark)

Question 8 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 30 · continued

8 (d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The electrolysis of sodium chloride solution also produces chlorine and sodium hydroxide.

In industry, the electrolysis of sodium chloride solution can be done in several types of electrolysis cell.

Some information about two different types of electrolysis cell is given below.

	Mercury cell	Membrane cell
Cost of construction	Expensive	Relatively cheap
Additional substances used	Mercury, which is recycled. Mercury is toxic so any traces of mercury must be removed from the waste.	Membrane, which is made of a polymer. The membrane must be replaced every 3 years.
Amount of electricity used for each tonne of chlorine produced in kWh	3400	2950
Quality of chlorine produced	Pure	Needs to be liquefied and distilled to make it pure.
Quality of sodium hydroxide solution produced	50% concentration. Steam is used to concentrate the sodium hydroxide solution produced.	30% concentration. Steam is used to concentrate the sodium hydroxide solution produced.

Use the information and your knowledge and understanding to compare the environmental and economic advantages and disadvantages of these **two** types of electrolysis cell.

.....

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4.10.2.2 Ways of reducing the use of resources

Question 31

June 2015 | CH1FP | Original Q1 | Legacy

1 This question is about metals.

1 (a) Which unreactive metal is found in the Earth as the metal itself?

[1 mark]

Tick (✓) **one** box.

aluminium ☐

gold ☐

magnesium ☐

1 (b) Complete the sentence.

[1 mark]

Aluminium is an element because aluminium is made of

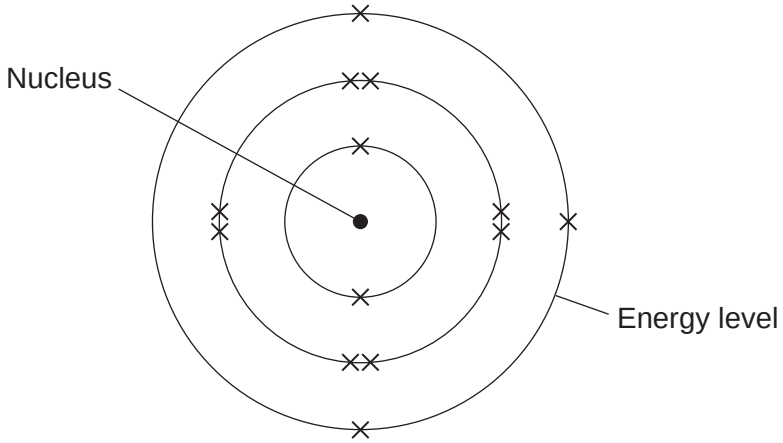
only one type of ..... .

4.10.2.2 Ways of reducing the use of resources

Question 31 · continued

1 (c) **Figure 1** shows the electronic structure of an aluminium atom.

Figure 1



1 (c) (i) Use the correct words from the box to complete the sentence.

[2 marks]

electrons	**ions**	**protons**	**neutrons**	**shells**

The nucleus of an aluminium atom contains ..... and ..... .

1 (c) (ii) Complete the sentence.

[1 mark]

In the periodic table, aluminium is in Group ..... .

Question 1 continues on the next page

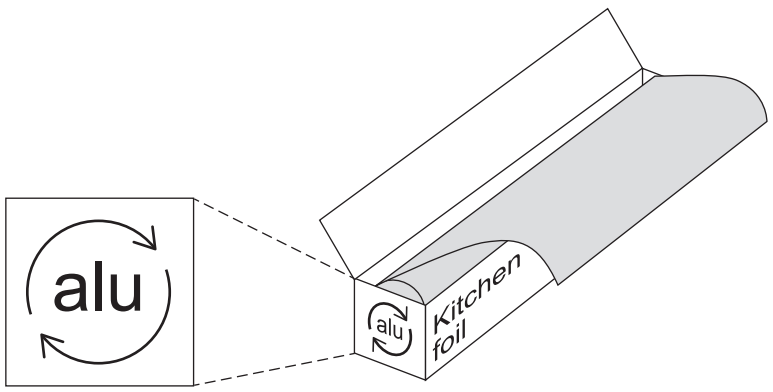
4.10.2.2 Ways of reducing the use of resources

Question 31 · continued

1 (d) Aluminium is used for kitchen foil.

Figure 2 shows a symbol on a box of kitchen foil.

Figure 2



The symbol means that aluminium can be recycled. It does not show the correct chemical symbol for aluminium.

1 (d) (i) What is the correct chemical symbol for aluminium? ..... .

[1 mark]

1 (d) (ii) Give **two** reasons why aluminium should be recycled.

[2 marks]

.....

.....

.....

.....

1 (e) Aluminium has a low density, conducts electricity and is resistant to corrosion.

Which **one** of these properties makes aluminium suitable to use as kitchen foil? Give a reason for your answer.

[2 marks]

.....

.....

.....

.....

10

4.10.2.2 Ways of reducing the use of resources

Question 32

June 2016 | CH1FP | Original Q3 | Legacy

3 Metals are extracted from ores in the Earth's crust.

3 (a) Why is copper used in the manufacture of computers?

[1 mark]

Tick (✓) **one** box.

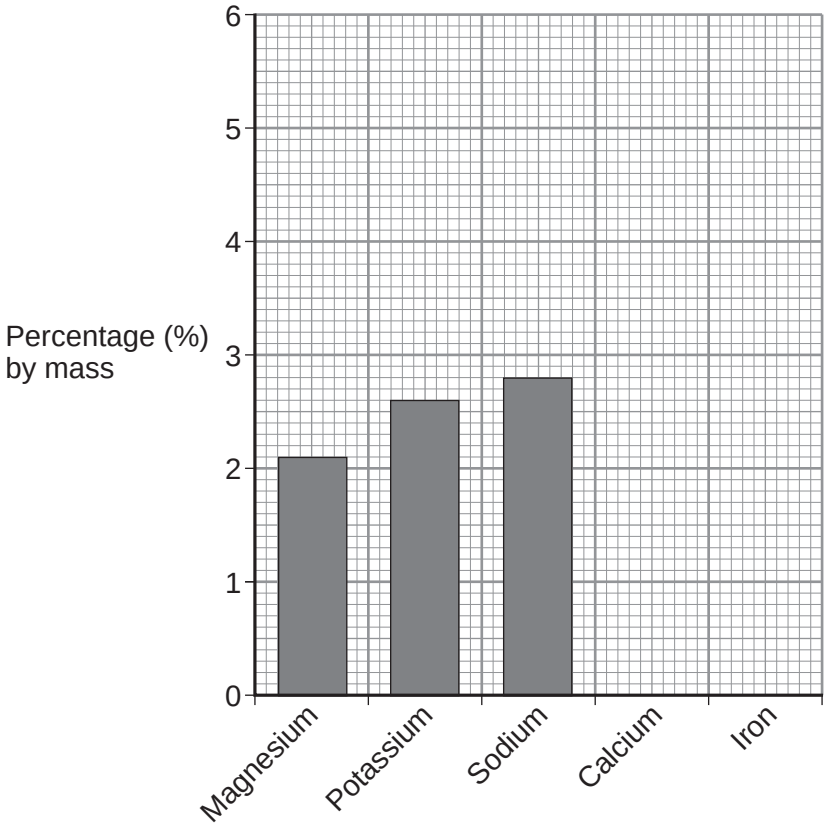
Because it has a high density. ☐

Because it does not react with water. ☐

Because it is a good conductor of electricity. ☐

3 (b) **Figure 6** shows the percentage (%) by mass of some metals in the Earth's crust.

Figure 6



4.10.2.2 Ways of reducing the use of resources

Question 32 · continued

3 (b) (i) What is the percentage by mass of magnesium in the Earth's crust?

[1 mark]

_____ %

3 (b) (ii) On **Figure 6** draw the bars for:

- calcium at 3.6% by mass
- iron at 5.0% by mass.

[2 marks]

3 (c) An ore of zinc contains zinc carbonate.

The equation for the reaction when zinc carbonate is heated is:

$$\underset{\text{zinc carbonate}}{ZnCO_3} \longrightarrow \underset{\text{zinc oxide}}{ZnO} + \underset{\text{carbon dioxide}}{CO_2}$$

3 (c) (i) What is the name of this type of reaction?

[1 mark]

Tick (✓) **one** box.

corrosion ☐

decomposition ☐

electrolysis ☐

3 (c) (ii) Which substance in the equation is a gas at room temperature (20 °C)?

[1 mark]

Tick (✓) **one** box.

zinc carbonate ☐

zinc oxide ☐

carbon dioxide ☐

Question 3 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 32 · continued

3 (c) (iii) Complete **Table 1** to show the number of atoms of carbon and oxygen in the formula of zinc carbonate.

[2 marks]

Table 1

Element	Number of atoms in the formula $ZnCO_3$
zinc, Zn	1
carbon, C	
oxygen, O	

3 (c) (iv) When 125 g zinc carbonate is heated, 81 g zinc oxide is produced.

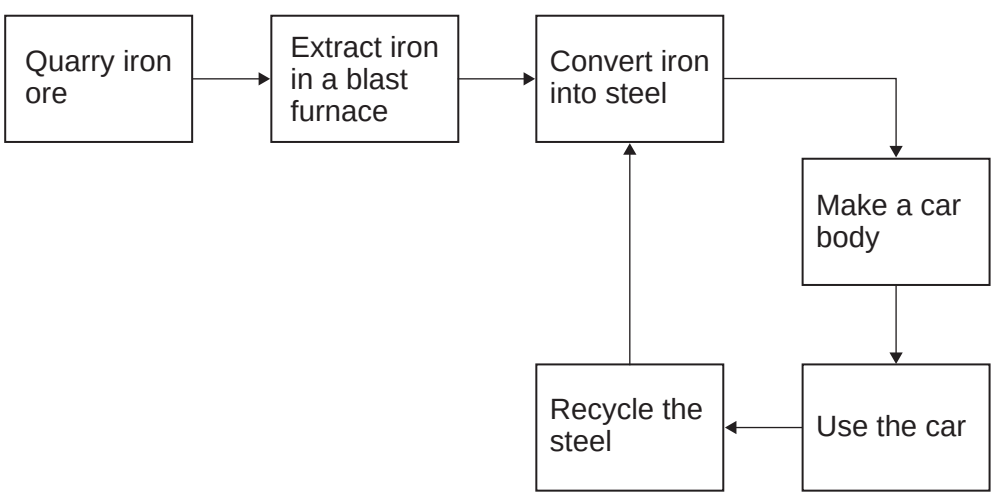
Calculate the mass of carbon dioxide produced.

[1 mark]

Mass of carbon dioxide = _____ g

3 (d) **Figure 7** shows a simple life cycle of a car body.

Figure 7



4.10.2.2 Ways of reducing the use of resources

Question 32 · continued

3 (d) (i) What is **one** reason why iron from the blast furnace is converted into steel?

[1 mark]

Tick (✓) **one** box.

To make the iron pure. ☐

To make the iron more brittle. ☐

To make alloys for specific uses. ☐

3 (d) (ii) Apart from cost, give **three different** reasons why steel should be recycled.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

13

4.10.2.2 Ways of reducing the use of resources

Question 33

June 2017 | CH1FP | Original Q3 | Legacy

3 This question is about metals.

3 (a) Complete the word equation for the reaction of magnesium with oxygen.

[1 mark]

magnesium + oxygen ⟶ _____

3 (b) Iron oxide is reduced to iron in a blast furnace.

The chemical equation for the reaction is:

$$2\ Fe_2O_3 + 3\ C \longrightarrow 4\ Fe + 3\ CO_2$$

3 (b) (i) Give the name of the element used for the reduction of iron oxide.

[1 mark]

_____

3 (b) (ii) How can you tell that iron oxide is reduced?

[1 mark]

_____

_____

3 (b) (iii) Complete the sentences.

[3 marks]

For many uses, iron from the blast furnace is too _____ .

For many uses, pure iron is too _____ .

Mixtures of iron with carbon are called _____ .

6

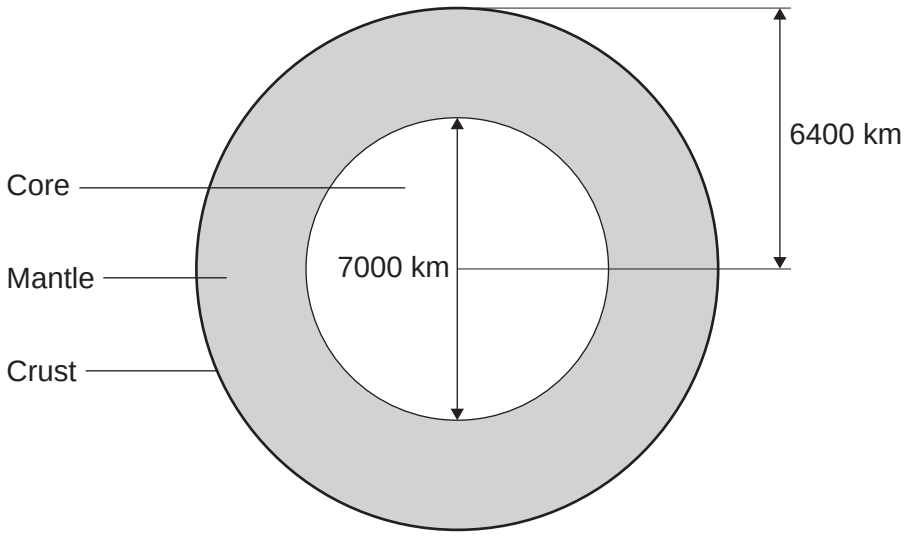
4.10.2.2 Ways of reducing the use of resources

Question 34

June 2017 | CH1FP | Original Q5 | Legacy

5 (a) **Figure 4** shows the layered structure of the Earth.

Figure 4



5 (a) (i) The radius of the Earth is 6400 km.

Calculate the distance from the surface of the crust to the surface of the core.

[2 marks]

_____

_____

Distance = _____ km

5 (a) (ii) Use the correct answers from the box to complete the sentences.

Each word can be used only once.

[4 marks]

currents	**concentrations**	**distances**
plates	**processes**	**speeds**

Tectonic _____ move at _____ of a few centimetres per year.

This movement is caused by convection _____ within the Earth's mantle

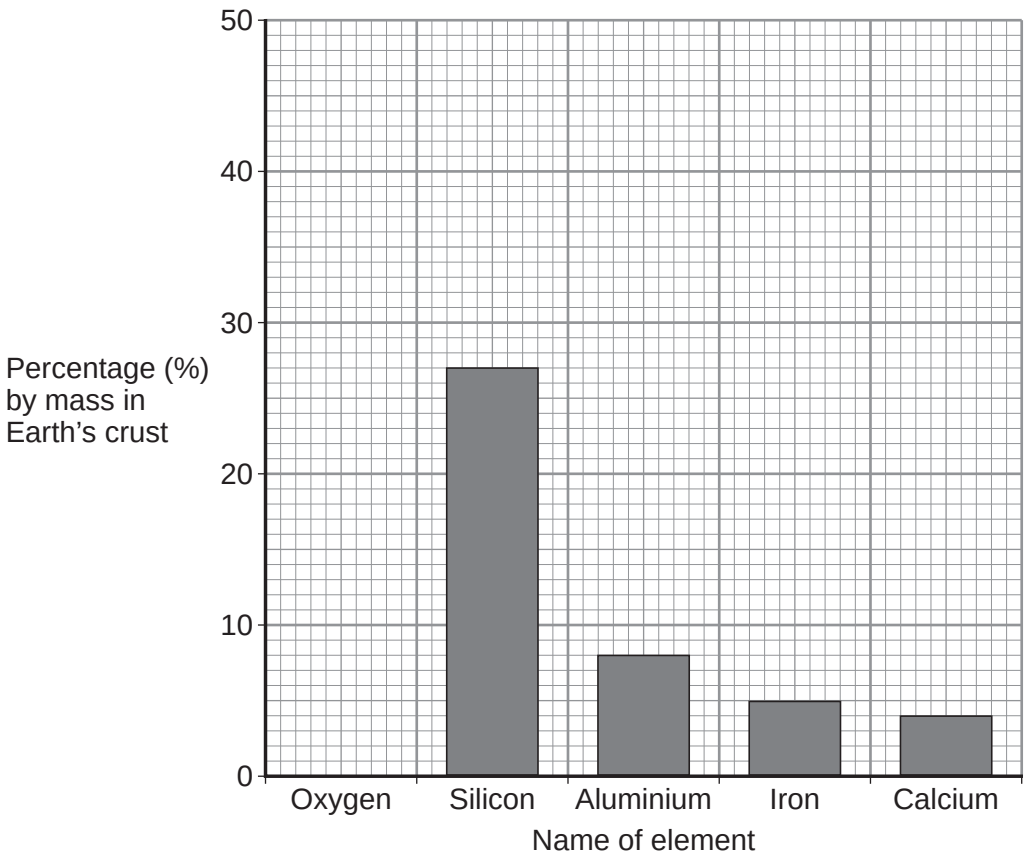
driven by heat released by natural radioactive _____ .

4.10.2.2 Ways of reducing the use of resources

Question 34 · continued

5 (b) **Figure 5** shows the percentage by mass of some elements in the Earth's crust.

Figure 5



5 (b) (i) The percentage by mass of oxygen is 47%.

Draw the bar for oxygen on **Figure 5**.

[1 mark]

5 (b) (ii) Look at your completed bar chart.

What is the percentage by mass of all the other elements not shown on the chart in the Earth's crust?

[1 mark]

Tick (✓) **one** box.

1% ☐

9% ☐

20% ☐

4.10.2.2 Ways of reducing the use of resources

Question 34 · continued

5 (b) (iii) There is about 0.007% by mass of copper in the Earth's crust.

Suggest why copper should be recycled.

[1 mark]

_____

_____

Question 5 continues on the next page

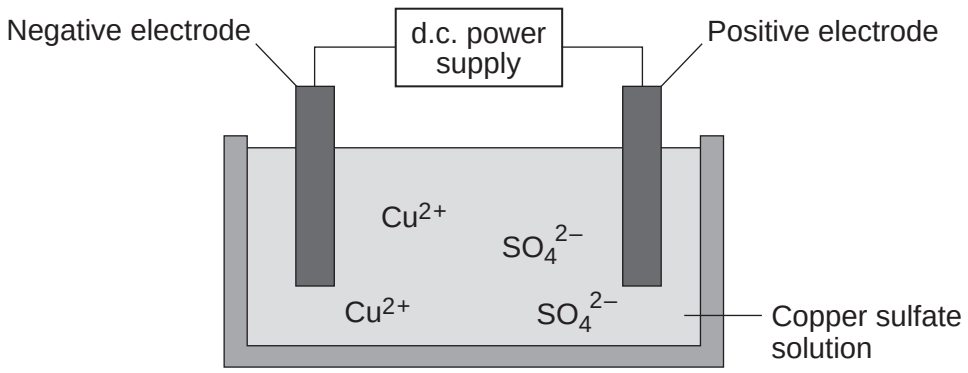
4.10.2.2 Ways of reducing the use of resources

Question 34 · continued

5 (b) (iv) Bioleaching of low-grade copper ores produces a solution of copper sulfate.

Figure 6 shows apparatus used to obtain copper from copper sulfate solution.

Figure 6



What is the name of the process shown in **Figure 6**?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Cracking ☐

Electrolysis ☐

Hydration ☐

5 (b) (v) Explain why copper ions move towards the negative electrode in **Figure 6**.

[2 marks]

12

4.10.2.2 Ways of reducing the use of resources

Question 35

June 2018 | 8462/2F | Original Q4

0 4 A 9 carat gold ring is made from a mixture of metals.

Table 3 shows the mass of different metals in the ring.

The mass of the ring is 5.0 g

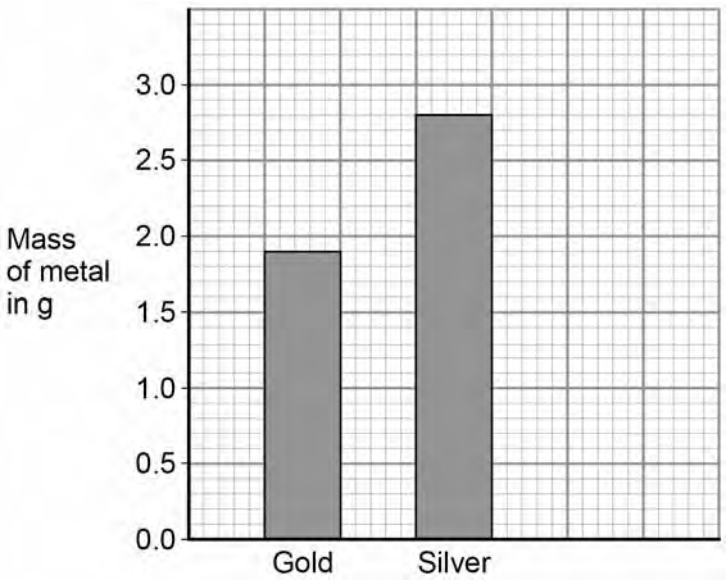
Table 3

Metal	Mass of metal in g
Gold	1.9
Silver	2.8
Copper	0.3

0 4 . 1 Plot the data for copper from **Table 3** on **Figure 1**.

[2 marks]

Figure 1



4.10.2.2 Ways of reducing the use of resources

Question 35 · continued

0 4 . 2 The cost of gold is £30 per gram.

Calculate the cost of the gold used in the 9 carat gold ring.

Use **Table 3**.

[1 mark]

Cost of gold = £ _____

0 4 . 3 Rings can be made from 22 carat gold.

The ratio of the mass of gold in 22 carat gold compared to 9 carat gold is 22 : 9

Calculate the mass of gold in a 22 carat gold ring of mass 5.0 g

Use **Table 3**.

[2 marks]

Mass of gold = _____ g

Question 4 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 35 · continued

0 4 . 4 Pure gold is 24 carat.

Suggest **two** reasons why silver and copper are mixed with gold to make 9 carat gold rings.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 5 Copper is obtained from copper ores or by recycling copper.

- Copper ores are non-renewable.
- Copper ores can be obtained by mining.
- Some scrap copper goes to landfill sites.

Give **three** reasons why we should use recycled copper instead of copper from copper ores.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

4.10.2.2 Ways of reducing the use of resources

Question 35 · continued

June 2018 | 8462/2F | Original Q4

Turn over for the next question

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

4.10.2.2 Ways of reducing the use of resources

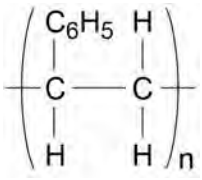
Question 36

June 2018 | 8462/2F | Original Q6

0 6 Disposable cups are made from coated paper or poly(styrene).

Figure 4 represents the structure of poly(styrene).

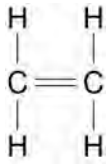
Figure 4



0 6 . 1 Which small molecule is used to produce poly(styrene)?

[1 mark]

Tick **one** box.



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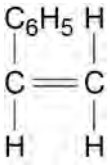

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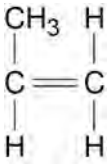

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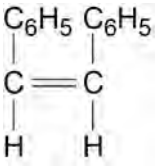


☐

4.10.2.2 Ways of reducing the use of resources

Question 36 · continued

0 6 . 2 Which process is used to make poly(styrene) from small molecules?

[1 mark]

Tick **one** box.

- Cracking ☐
- Distillation ☐
- Fermentation ☐
- Polymerisation ☐

0 6 . 3 Complete the sentences.

Choose answers from the box.

[3 marks]

ceramics	**composites**	**four**	**many**
monomers	**polymers**	**two**	

Poly(styrene) is produced from small molecules called _____.

When poly(styrene) is made, _____ styrene molecules join to form large molecules.

These large molecules are called _____.

Question 6 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 36 · continued

0 6 . 4 **Table 4** gives some information about disposable cups.

Table 4

	Coated paper cups	Poly(styrene) cups
Source of raw materials	Wood	Crude oil
Energy to make 1 cup in arbitrary units	550	200
Biodegradable	Yes	No
Recyclable	No	Yes

Compare the advantages and disadvantages of using coated paper and poly(styrene) to make disposable cups.

Use **Table 4** and your knowledge and understanding of life cycle assessments (LCAs).

[4 marks]

4.10.2.2 Ways of reducing the use of resources

Question 37

June 2019 | 8462/2F | Original Q5

0 5 **Figure 3** shows a surfer on a surfboard.

Figure 3



Some surfboards are made from addition polymers.

Addition polymers are made from small alkene molecules.

0 5 . 1 Which type of bonding is present in small alkene molecules?

[1 mark]

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

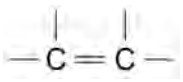
4.10.2.2 Ways of reducing the use of resources

Question 37 · continued

0 5 . 2 What is the functional group in these small alkene molecules?

[1 mark]

Tick (✓) **one** box.



☐

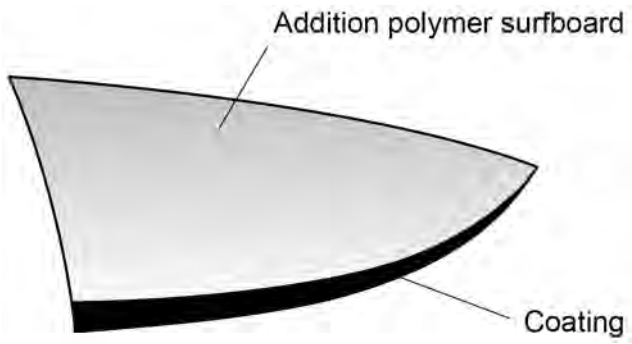
—COOH ☐

—OH ☐

Figure 4 shows the structure of part of an addition polymer surfboard.

The outer surface of the surfboard is coated.

Figure 4



The coating is made from soda-lime glass fibres surrounded by a plastic.

0 5 . 3 What type of material is the coating of the surfboard?

[1 mark]

Tick (✓) **one** box.

Alloy ☐

Ceramic ☐

Composite ☐

Nanotube ☐

4.10.2.2 Ways of reducing the use of resources

Question 37 · continued

0 5 . 4 Complete the sentence.

Choose answers from the box.

[2 marks]

air	**ammonia**	**copper**
limestone	**sand**	

The materials used to make the soda-lime glass fibres are sodium carbonate,

_____ and _____.

0 5 . 5 Suggest **two** reasons why surfboards are coated.

[2 marks]

1 _____

_____

2 _____

_____

Some surfboards are made from wood.

Table 3 contains information about the materials in an addition polymer surfboard and a wooden surfboard.

Table 3

	Addition polymer surfboard	Wooden surfboard
Relative strength	14	38
Cost (£ per m^3)	140	390
Density (kg/m^3)	50	150
Disposal at end of life	Difficult to recycle	Can be used as fuel

4.10.2.2 Ways of reducing the use of resources

Question 37 · continued June 2019 | 8462/2F | Original Q5

0 5 . 6 Suggest **two** advantages and **two** disadvantages of using addition polymers rather than wood to make surfboards.

Use **Table 3**.

[4 marks]

Advantages of addition polymers _____

_____

_____

_____

Disadvantages of addition polymers _____

_____

_____

_____

0 5 . 7 Calculate the volume of wood in a wooden surfboard of mass 5.25 kg

Use **Table 3** and the equation:

$$\text{Density in kg/m}^3 = \frac{\text{Mass in kg}}{\text{Volume in m}^3}$$

[3 marks]

_____

_____

_____

_____

Volume = _____ m^3

14

4.10.2.2 Ways of reducing the use of resources

Question 38

November 2020 | 8462/2F | Original Q6

0 6 This question is about materials used to make plates.

Plates are made from ceramics, paper or poly(propene).

0 6 . 1 Paper plates are biodegradable and recyclable.

Which stage of a life cycle assessment (LCA) would contain this information?

[1 mark]

Tick (✓) **one** box.

- Disposal at the end of useful life ☐
- Extracting and processing raw materials ☐
- Manufacturing and packaging ☐
- Use and operation during lifetime ☐

0 6 . 2 Which **two** processes are used to make ceramic plates?

[2 marks]

Tick (✓) **two** boxes.

- Forming a composite ☐
- Galvanising with zinc ☐
- Heating in a furnace ☐
- Melting sand and boron trioxide ☐
- Shaping wet clay ☐

4.10.2.2 Ways of reducing the use of resources

Question 38 · continued

Poly(propene) is produced from an alkene.

0 6 . 3 Complete the sentences.

[2 marks]

The name for very large molecules such as poly(propene) is _____.

The name of the alkene used to produce poly(propene) is _____.

0 6 . 4 The alkene needed to make poly(propene) is produced from crude oil.

Which **two** processes are used to produce this alkene from crude oil?

[2 marks]

Tick (✓) **two** boxes.

- Chromatography ☐
- Cracking ☐
- Fermentation ☐
- Fractional distillation ☐
- Quarrying ☐

0 6 . 5 What type of bond joins the atoms in a molecule of poly(propene)?

[1 mark]

Tick (✓) **one** box.

- Covalent ☐
- Ionic ☐
- Metallic ☐

4.10.2.2 Ways of reducing the use of resources

Question 38 · continued

Table 4 shows information about two polymers used to make plates.

Table 4

Polymer	Effect of heating the polymer
A	does not melt
B	melts at 50 °C

0 6 . 6 What type of polymer is polymer **A**?

Use **Table 4**.

[1 mark]

0 6 . 7 Why does polymer **A** behave differently to polymer **B** when heated?

You should refer to crosslinks in your answer.

[1 mark]

10

4.10.2.2 Ways of reducing the use of resources

Question 39

June 2022 | 8462/2F | Original Q5

0 5 Ammonia is produced in the Haber process.

The raw materials for the Haber process are nitrogen and hydrogen.

0 5 . 1 Draw **one** line from each raw material to the source of that raw material.

[2 marks]

Raw material	Source of raw material
	Air
	Clay
Nitrogen	
	Limestone
Hydrogen	
	Natural gas
	Sand

0 5 . 2 What are the states of nitrogen and of hydrogen when used in the Haber process?

[1 mark]

Tick (✓) **one** box.

State of nitrogen	State of hydrogen	
Gas	Gas	☐
Gas	Liquid	☐
Liquid	Gas	☐
Liquid	Liquid	☐

4.10.2.2 Ways of reducing the use of resources

Question 39 · continued

0 5 . 3 The word equation for the production of ammonia is:

nitrogen + hydrogen ⇌ ammonia

The atom economy of the reaction is 100%.

How does the word equation show that the atom economy is 100%?

[1 mark]

Tick (✓) **one** box.

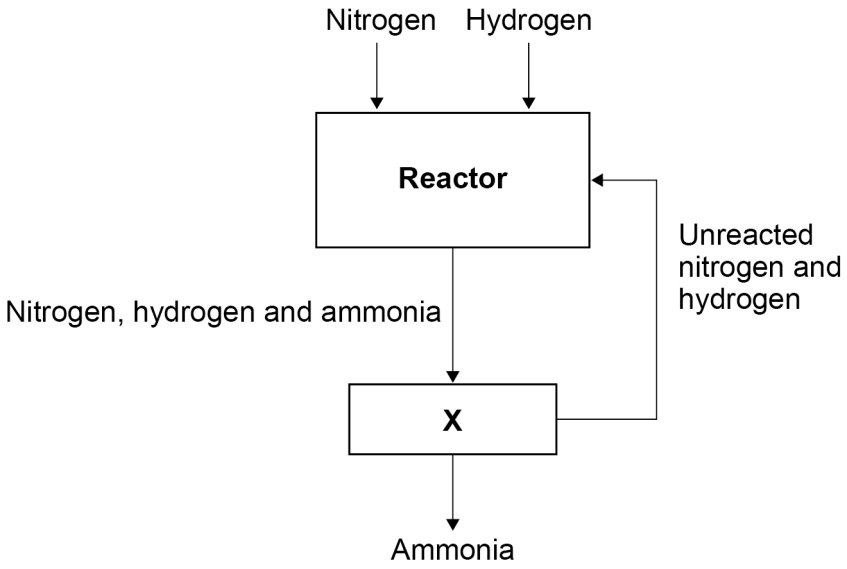
- The reaction is reversible. ☐
- There are two reactants. ☐
- There is one product. ☐

4.10.2.2 Ways of reducing the use of resources

Question 39 · continued

0 5 . 4 **Figure 5** represents the Haber process.

Figure 5



A mixture of nitrogen, hydrogen and ammonia enters **X**.

Complete the sentences.

Choose answers from the box.

[2 marks]

evaporated	**filtered**	**liquefied**	**recycled**

In **X**, the mixture is cooled.

The ammonia can be removed from **X** because the ammonia is

_____.

The unreacted nitrogen and hydrogen are

_____.

4.10.2.2 Ways of reducing the use of resources

Question 39 · continued

Table 8 shows the percentage yield of ammonia at different pressures.

Table 8

Pressure in atmospheres	Percentage (%) yield of ammonia
50	20
100	33
150	44
200	52
250	59
300	64

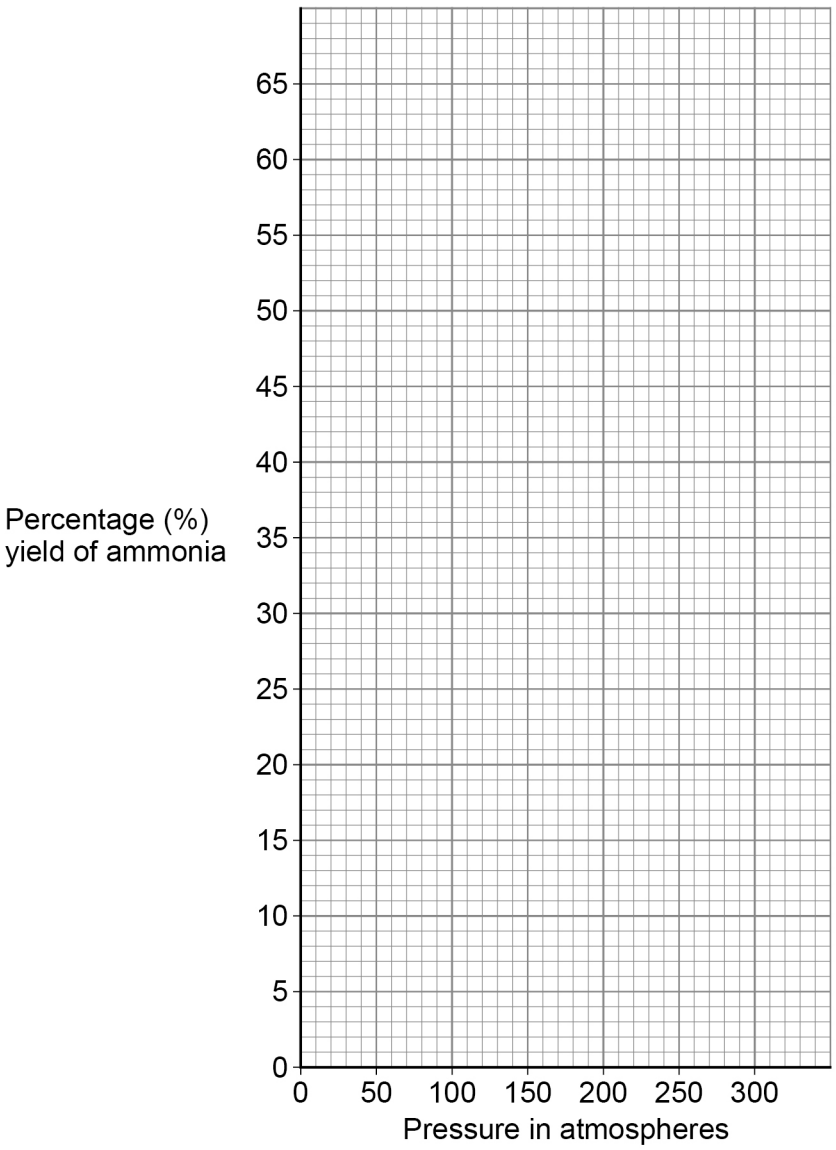
Question 39 · continued

0 5 . 5 Plot the data from **Table 8** on **Figure 6**.

Draw a line of best fit.

[3 marks]

Figure 6



0 5 . 6 What is the effect of increasing the pressure on the percentage yield of ammonia?

Use **Table 8**.

[1 mark]

10

4.10.2.2 Ways of reducing the use of resources

Question 40

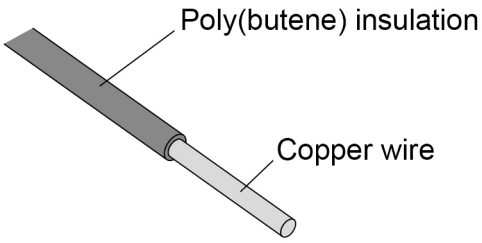
June 2022 | 8462/2F | Original Q8

0 8 This question is about copper wire and copper compounds.

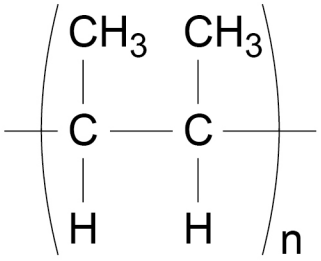
Copper is used to make electrical wires.

Figure 9 shows how copper electrical wire is insulated using an addition polymer called poly(butene).

Figure 9



0 8 . 1 The addition polymer poly(butene) has the displayed structural formula:

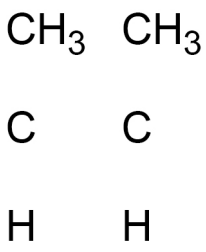


Poly(butene) is produced from the monomer butene.

Complete **Figure 10** to show the displayed structural formula of butene.

[2 marks]

Figure 10



4.10.2.2 Ways of reducing the use of resources

Question 40 · continued

Copper can be obtained by recycling scrap copper wire.

0 8 . 2 Suggest why poly(butene) insulation must be removed from scrap copper wire before the copper is recycled.

[1 mark]

0 8 . 3 Describe how scrap copper wire can be recycled to make new copper water pipes.

[2 marks]

0 8 . 4 Suggest **two** reasons why recycling scrap copper is more sustainable than extracting copper from copper ores.

[2 marks]

1

2

Question 8 continues on the next page

4.10.2.2 Ways of reducing the use of resources

Question 40 · continued June 2022 | 8462/2F | Original Q8

Copper sulfate is a compound of copper.

Copper sulfate solution contains copper(II) ions and sulfate ions.

0 8 . 5 A solution can be added to copper sulfate solution to show the presence of copper(II) ions.

Name the solution added.

Give the result of the test.

[2 marks]

Name of solution added _____

_____

Result _____

_____

0 8 . 6 Describe **one** test to show the presence of sulfate ions in copper sulfate solution.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

_____

11

4.10.2.2 Ways of reducing the use of resources

Question 41

June 2022 | 8462/2F | Original Q10

1 0 This question is about life cycle assessments (LCAs).

1 0 . 1 Milk bottles can be made from glass or from a polymer.

Table 10 shows information about milk bottles of equal volume.

Table 10

	Glass	Polymer
Raw materials	Limestone Sand Sodium carbonate	Crude oil
Energy needed to process raw materials in kilojoules	6750	1710
Energy needed to manufacture bottle in kilojoules	750	90
Mass of bottle in grams	200	20
Mean number of times used during lifetime of bottle	25	1
One disposal method at end of useful life	Recycled to make different glass products	Recycled to make different polymer products

Evaluate the use of glass for milk bottles compared with the use of a polymer for milk bottles.

Use features of life cycle assessments (LCAs) in your answer.

Use **Table 10**.

[6 marks]

4.10.2.2 Ways of reducing the use of resources

Question 41 · continued June 2022 | 8462/2F | Original Q10

10.2 Milk is also sold in cardboard cartons.

A carton is made using 40 cm^3 of cardboard.

The density of the cardboard is 0.40 g/cm^3.

Calculate the mass of the carton.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

[3 marks]

Mass = _____ g

9