AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.1.1

Pure substances

Past-paper questions

Tier	**Higher**
Question groups	**17**
Available paper years	**2007–2024**

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.

4.8.1.1 Pure substances

Question 01

June 2007 | CHY1H | Original Q2 | Legacy

2 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.

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(2 marks)

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

Describe and explain what happens during this reaction.

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(2 marks)

Question 01 · continued

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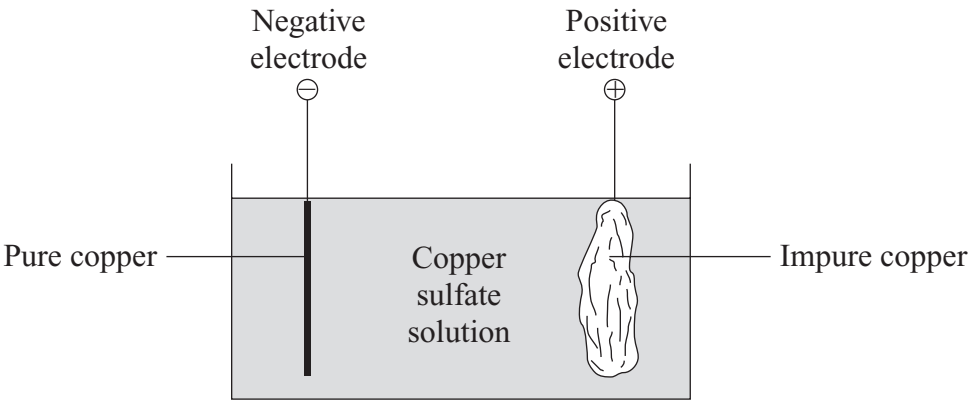
(c) During the third stage the copper can be purified as shown in the diagram.



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

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(1 mark)

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

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(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.

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(3 marks)

10

4.8.1.1 Pure substances

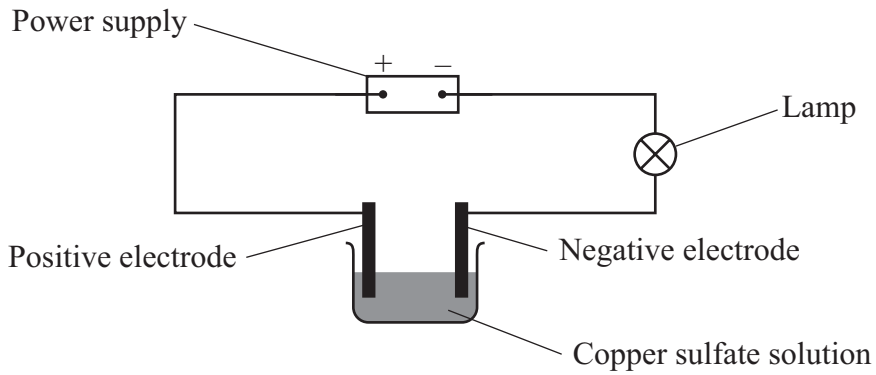
Question 02

June 2008 | CHY2H | Original Q2 | Legacy

2 A student investigated the electrolysis of copper sulfate solution.
The student's method is shown in the box.

Two clean pieces of copper were weighed. One piece was used as the positive electrode and the other piece was used as the negative electrode.

The circuit was set up as shown in the diagram.



After the electrolysis, the pieces of copper were:

- washed with distilled water
- washed with propanone (a liquid with a lower boiling point than water)
- allowed to dry
- weighed.

2 (a) Explain why the electrode would dry faster when washed with propanone instead of water.

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(1 mark)

2 (b) The student's results are given in the table.

	Positive electrode	**Negative electrode**
mass of electrode before electrolysis, in grams	16.41	15.46
mass of electrode after electrolysis, in grams	16.10	15.75

The mass of the positive electrode decreased by 0.31 g.

4.8.1.1 Pure substances

Question 02 · continued

for mark

2 (b) (i) What is the change in mass of the negative electrode? ..... g

(1 mark)

2 (b) (ii) The mass lost by the positive electrode should equal the mass gained by the negative electrode.

Suggest **two** reasons why the results were **not** as expected.

1 .....

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(2 marks)

2 (c) Describe and explain how electrolysis is used to make pure copper from a lump of impure copper.

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(4 marks)

8

4.8.1.1 Pure substances

Question 03

June 2009 | CHY1H | Original Q6 | Legacy

6 (a) PEX is a material that is used as an alternative to copper for hot water pipes. PEX is made from poly(ethene).

6 (a) (i) Describe how ethene forms poly(ethene).

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(2 marks)

6 (a) (ii) PEX is a shape memory polymer. What property does a shape memory polymer have?

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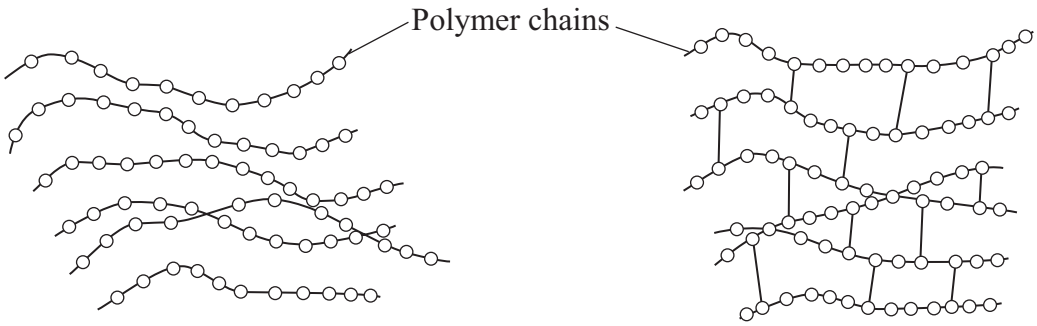
(1 mark)

6 (a) (iii) The simplified structures of poly(ethene) and PEX are shown.



Poly(ethene) **PEX**

Poly(ethene) is a thermoplastic that softens easily when heated.

Suggest and explain how the structure of PEX changes this property.

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(3 marks)

4.8.1.1 Pure substances

Question 03 · continued

for mark

6 (b) Copper was considered to be the most suitable material to use for hot water pipes. PEX is now used as an alternative material for hot water pipes.

Copper is extracted from its ore by a series of processes.

1 The low-grade ore is powdered and concentrated.
2 Smelting is carried out in an oxygen flash furnace. This furnace is heated to 1100 °C using a hydrocarbon fuel. The copper ore is blown into the furnace with air, producing impure, molten copper.
3 Oxygen is blown into the impure, molten copper to remove any sulfur. The copper is cast into rectangular slabs.
4 The final purification of copper is done by electrolysis.

PEX is made from crude oil by a series of processes.

1 Fractional distillation
2 Cracking
3 Polymerisation
4 Conversion of poly(ethene) into PEX

Suggest the possible environmental advantages of using PEX instead of copper for hot water pipes.

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(4 marks)

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4.8.1.1 Pure substances

Question 04

November 2009 | CHY1BP | Original Q8 | Legacy

QUESTION EIGHT

This question is about ethanol. Some ethanol is used as a fuel to replace petrol.

The table compares two different industrial processes for making ethanol.

Process	Raw material	Type of process	Purity of product	Rate of ethanol production
Fermentation using yeast	Sugar	Batch – one tank of sugar solution is fermented at a time	Dilute solution of ethanol	Slow
Hydration using steam	Ethene	Continuous – ethene and steam flow steadily into the reaction vessel and ethanol flows steadily out	Almost pure ethanol	Fast

8A Ethene is obtained from the hydrocarbons in crude oil by . . .

1 thermal decomposition.

2 hydration.

3 fractional distillation.

4 polymerisation.

8B In some countries, very little ethanol for fuel is produced by fermentation because . . .

1 ethene is obtained from a non-renewable resource.

2 they have a hot climate suitable for growing sugar cane.

3 they are wealthy enough to import oil from abroad.

4 the ethanol from fermentation produces more carbon dioxide when burnt.

8C Which of the following is **not** a reason why an ethanol factory using sugar takes longer to produce ethanol than a factory using ethene?

1 A fermentation tank has to be emptied and cleaned after each batch.

2 After fermentation, the ethanol needs to be separated from water.

3 Sugar cane plants take a long time to grow.

4 Yeast takes several days to convert sugar into ethanol.

4.8.1.1 Pure substances

Question 04 · continued

8D Who would benefit economically if ethanol was made by hydration of ethene rather than by fermentation?

1 investors in the fermentation industry

2 oil companies

3 environmental pressure groups

4 sugar cane farmers

Turn over for the next question

4.8.1.1 Pure substances

Question 05

5 In the UK copper is produced from imported blister copper (98% pure), which has been extracted from copper ores.

5 (a) In the first stage of purification, air is blown into molten blister copper to remove any sulfur.

5 (a) (i) The sulfur reacts to form a gas that should **not** be allowed to escape into the atmosphere.

Explain why.

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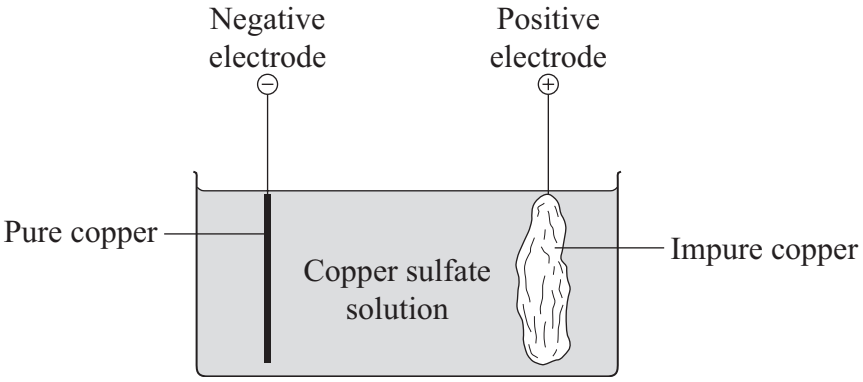
(2 marks)

5 (a) (ii) After the removal of sulfur the slightly impure copper is cast into anodes. The copper in these anodes is purified by the process shown.



What is the name of this type of process?

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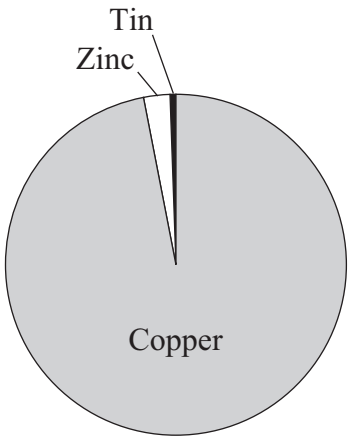
(1 mark)

4.8.1.1 Pure substances

Question 05 · continued

for mark

5 (b) One use of copper is to make 2p coins.



The composition of a 2p coin in 1991

5 (b) (i) How was copper made harder for use in 2p coins in 1991?

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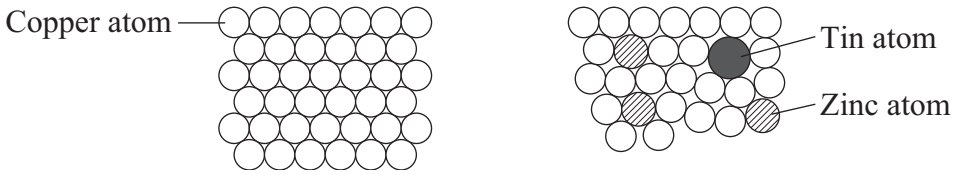
(1 mark)

5 (b) (ii) Use the diagrams to help you to explain why the metal used in 2p coins was harder than pure copper.



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(2 marks)

6

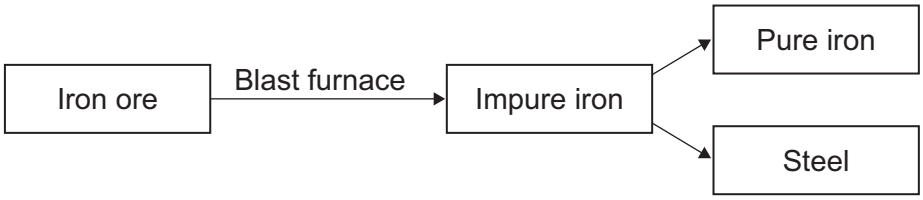
4.8.1.1 Pure substances

Question 06

June 2010 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The flow chart shows how iron ore can be changed into useful materials.



3A Iron ore is the starting material for making iron because . . .

1 iron ore is magnetic.

2 iron ore contains a reasonable amount of iron oxide.

3 a lot of energy is needed to convert iron ore into iron.

4 mining iron ore does not cause any environmental problems.

3B In the blast furnace, iron oxide is converted to iron using carbon. This is because . . .

1 iron is less reactive than carbon.

2 iron is more reactive than carbon.

3 carbon is a cheap material to use.

4 carbon combines with the metal impurities in the iron ore, leaving iron.

4.8.1.1 Pure substances

3C Impure iron is hard and brittle. This is because in impure iron . . .

1 the impurities distort the layers of atoms so they cannot slide over each other.

2 the carbon breaks up the iron structure, allowing it to bend easily.

3 its structure has been destroyed by heating to a very high temperature.

4 all the atoms are the same and so remain in a regular arrangement.

3D When impure iron is converted into steel, . . .

1 all the carbon is removed and not replaced.

2 the amount of carbon is carefully controlled.

3 all the metal impurities are removed and not replaced.

4 chromium is always added to the iron.

Turn over for the next question

4.8.1.1 Pure substances

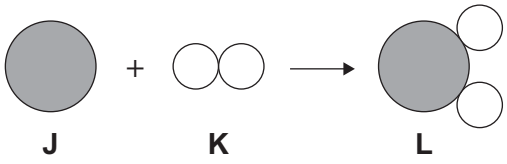
Question 07

June 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

The diagram represents the reaction between substance **J** and substance **K** to create a new substance, **L**.

In the diagram, each circle represents an atom.



4A Which substance or substances are elements?

1 **J** only

2 both **K** and **L**

3 both **J** and **K**

4 **L** only

4B Substance **L** . . .

1 is an impure substance.

2 is a mixture.

3 will have the same chemical properties as substances **J** and **K**.

4 is a compound of **J** and **K**.

4C When substance **L** is formed from substances **J** and **K** . . .

1 there is an overall increase in mass.

2 there is an overall decrease in mass.

3 there is no overall change in mass.

4 the total number of atoms changes.

4D A molecule of substance **K** will . . .

1 have two separate nuclei.

2 share a nucleus.

3 not have any chemical bonds.

4 not contain any electrons.

4.8.1.1 Pure substances

Question 08

March 2011 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

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.

4A 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.

4B 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.

4C 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.

4D 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.

4.8.1.1 Pure substances

Question 09

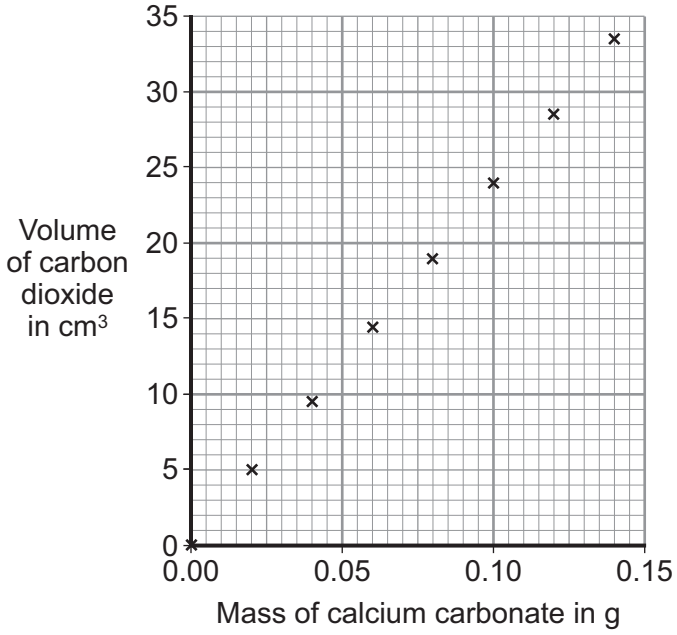
March 2011 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

When calcium carbonate is heated it decomposes, forming calcium oxide and carbon dioxide.

$$\underset{CaCO_3}{\text{calcium carbonate}} \rightarrow \underset{CaO}{\text{calcium oxide}} + \underset{CO_2}{\text{carbon dioxide}}$$

A student investigated how the quantity of carbon dioxide produced varies with the quantity of calcium carbonate that decomposes. The graph shows the results of the investigation.



7A What conclusion can be correctly drawn from these results?

1 The volume of carbon dioxide is independent of the mass of calcium carbonate.

2 The volume of carbon dioxide is directly proportional to the mass of calcium carbonate.

3 The volume of carbon dioxide is indirectly proportional to the mass of calcium carbonate.

4 There is no relationship between the volume of carbon dioxide and the mass of calcium carbonate.

7B The student repeated the investigation using the same masses of an impure sample of calcium carbonate. This sample contained 10 % of a substance that did not decompose on heating.

Which one of the following would describe the graph obtained?

1 a straight line that then levels off at just over 0.1 g of calcium carbonate

2 a straight line that has a gradient that is 10 % steeper throughout the whole range

3 a curved line that increases by 10 % for each point on the graph

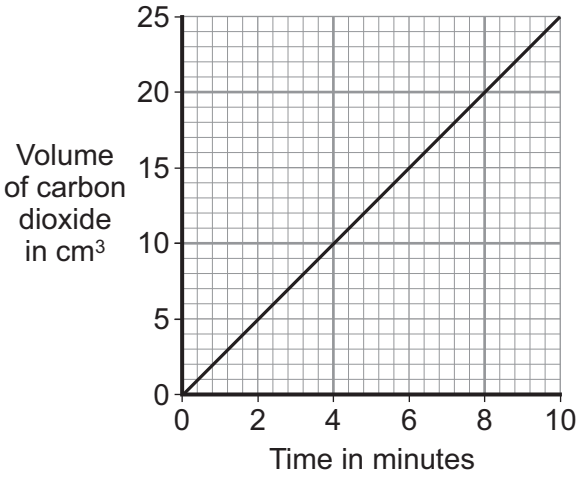
4 a straight line with a gradient that is less than the original sample

Question 09 · continued

7C The student repeated the first experiment using 0.1g of calcium carbonate and measured the volume of carbon dioxide produced every minute until the reaction had finished.

Which of the following graphs could the student's results produce?

1



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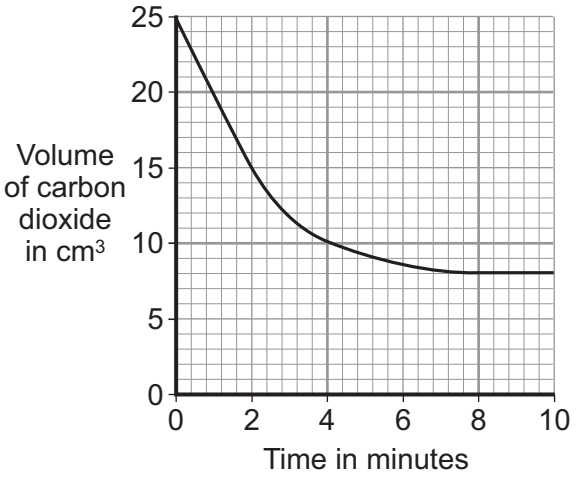

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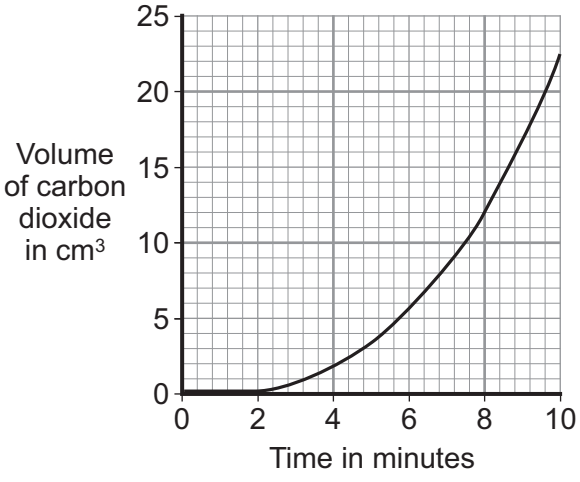

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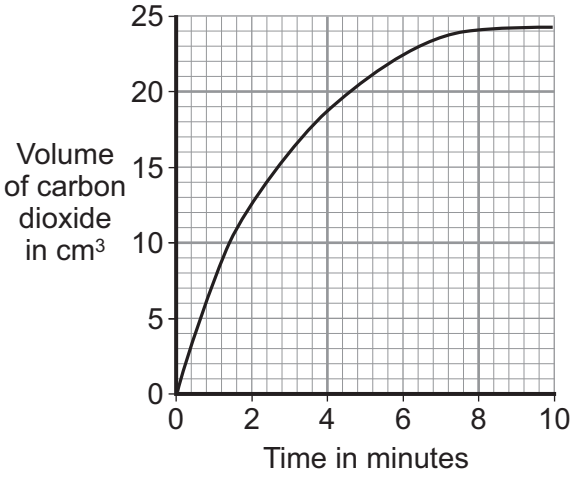


7D 5.0 grams of sodium carbonate were heated in a Bunsen burner flame.

There was no loss in mass after heating for 3 minutes.

A correct conclusion that can be drawn from this information is that . . .

1 sodium carbonate would decompose if heated for longer than 3 minutes.

2 sodium carbonate decomposes only at higher temperatures.

3 the mass of sodium oxide produced was equal to the mass of sodium carbonate heated.

4 sodium carbonate does **not** decompose at Bunsen burner temperatures.

4.8.1.1 Pure substances

Question 10

June 2011 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

Iron and copper can be extracted from their oxides by reduction with carbon.
Aluminium cannot be extracted from its oxide in this way.

Copper can be found in the Earth's crust as the metal itself.
Iron and aluminium are found only as compounds in the Earth's crust.

5A Which row in the table shows the order of reactivity of the four elements in the passage above?

	Most reactive →			Least reactive
1	copper	iron	aluminium	carbon
2	aluminium	carbon	iron	copper
3	carbon	copper	iron	aluminium
4	iron	aluminium	copper	carbon

5B Iron can be extracted from iron oxide, Fe_2O_3, by mixing the oxide with carbon and heating strongly in air.

Which row in the table below shows the name of the process and the products of the reaction?

	Name of the process	Products of the reaction
1	electrolysis	Fe, O_2 and CO_2
2	reduction	Fe and CO_2
3	electrolysis	Fe and CO_2
4	reduction	Fe, O_2 and CO_2

4.8.1.1 Pure substances

Question 10 · continued

5C Copper is extracted from high grade ores by first heating them strongly in a furnace to obtain impure copper. This is called smelting. Pure copper is then obtained by electrolysis.

Copper is extracted from low grade ores by leaching. A solution of sulfuric acid is run through the ores to produce a solution of copper sulfate. Electrolysis of this solution gives pure copper.

An advantage of leaching over smelting is that . . .

1 leaching uses less energy.

2 leaching causes no environmental damage.

3 leaching leaves no waste.

4 leaching produces purer copper.

5D Extraction of aluminium from its ores requires a lot of energy. Aluminium obtained by recycling scrap aluminium saves about 95% of this energy.

Another advantage of recycling scrap aluminium is that . . .

1 large, new aluminium ore mines will be developed.

2 alternative metals will replace aluminium in making drinks cans.

3 deposits of aluminium ore will last longer.

4 recycled aluminium contains other metals.

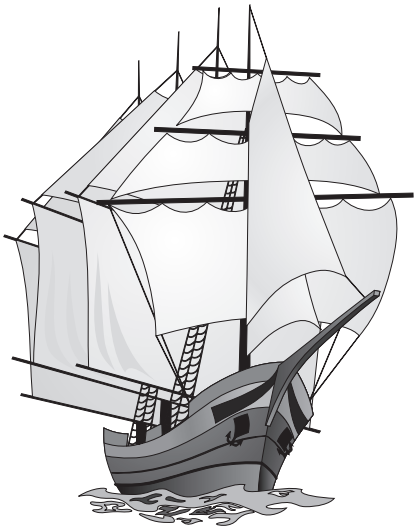
4.8.1.1 Pure substances

Question 11

June 2011 | CHY3H | Original Q2 | Legacy

2 Read the information about protecting the bottoms of ships.

A Copper-bottomed Investment



From the 16th to the 19th century, the bottoms of many wooden ships were protected from marine organisms by being covered with sheets of metal.

At first lead was used on the bottoms of ships, then copper was used until 1832 when Muntz Metal replaced it. Muntz Metal is an alloy of two transition metals, copper and zinc.

Table of data

	Lead	Copper	Muntz Metal
Cost (£/kg)	£1.20	£3.20	£2.30
Melting point (°C)	327	1083	904
Stops sea worms attacking wood	Yes	Yes	Yes
Stops barnacles and seaweed sticking to the bottom of the ship	No	Yes	Yes

4.8.1.1 Pure substances

Question 11 · continued June 2011 | CHY3H | Original Q2 | Legacy

2 (a) Use the information to answer the following questions.

2 (a) (i) Suggest why copper replaced lead.

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(1 mark)

2 (a) (ii) Suggest why Muntz Metal replaced copper.

.....

.....

(1 mark)

2 (b) A sample of Muntz Metal contains a very small amount of iron as an impurity.

2 (b) (i) Name an instrumental method of analysis that could be used to detect iron.

.....

(1 mark)

2 (b) (ii) Suggest why an instrumental method would detect the iron in this sample of Muntz Metal but a chemical method is **not** likely to be successful.

.....

.....

(1 mark)

2 (c) Today, ships are made from steel. Steels are alloys of iron, a transition metal.

Give **two** properties of transition metals that make them suitable for making ships.

Property 1 .....

.....

Property 2 .....

.....

(2 marks)

6

4.8.1.1 Pure substances

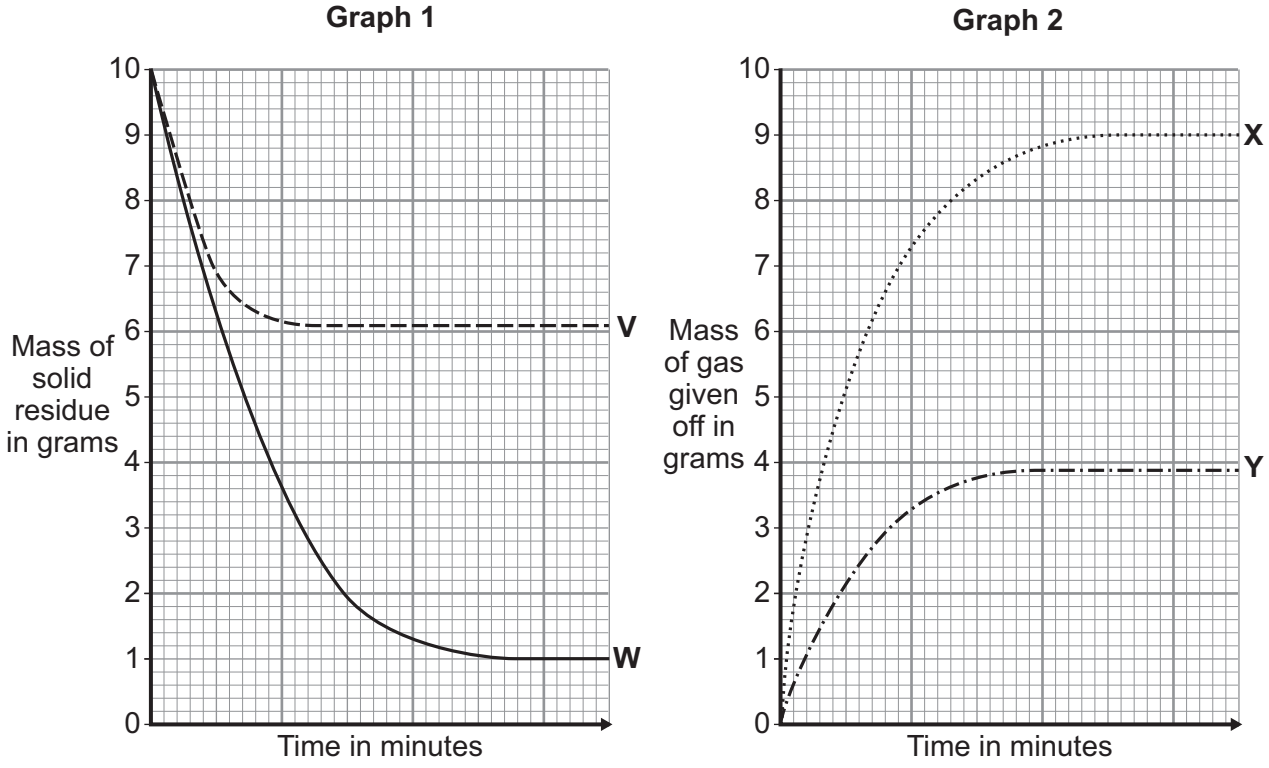
Question 12

November 2011 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

This question is about limestone and dolomite.

8A 10 g of limestone, which contained 10 % of an unreactive impurity, was heated strongly. The mass of the solid residue (**Graph 1**) and the mass of gas (**Graph 2**) given off were both recorded against time.



Which of the following lines on the graphs would be produced?

1 **V** and **X**

2 **V** and **Y**

3 **W** and **X**

4 **W** and **Y**

8B The formula for dolomite can be written as $CaMg(CO_3)_2$

What is the total number of atoms shown in this formula for dolomite?

1 4

2 7

3 10

4 12

4.8.1.1 Pure substances

Question 12 · continued

8C Dolomite contains calcium carbonate and magnesium carbonate.

Magnesium carbonate decomposes when heated to temperatures above 540 °C.
Calcium carbonate decomposes when heated to temperatures above 900 °C.

Which row in the table correctly describes what happens when dolomite is heated to 750 °C?

	Calcium carbonate	Magnesium carbonate
1	No change	Undergoes reduction
2	Undergoes reduction	No change
3	No change	Undergoes thermal decomposition
4	Undergoes thermal decomposition	No change

8D Which of the following correctly completes and balances the equation for the total decomposition of dolomite?

$CaMg(CO_3)_2 \rightarrow$

1 $CaO + 2MgO + CO_2$

2 $CaO + Mg + 2CO_2$

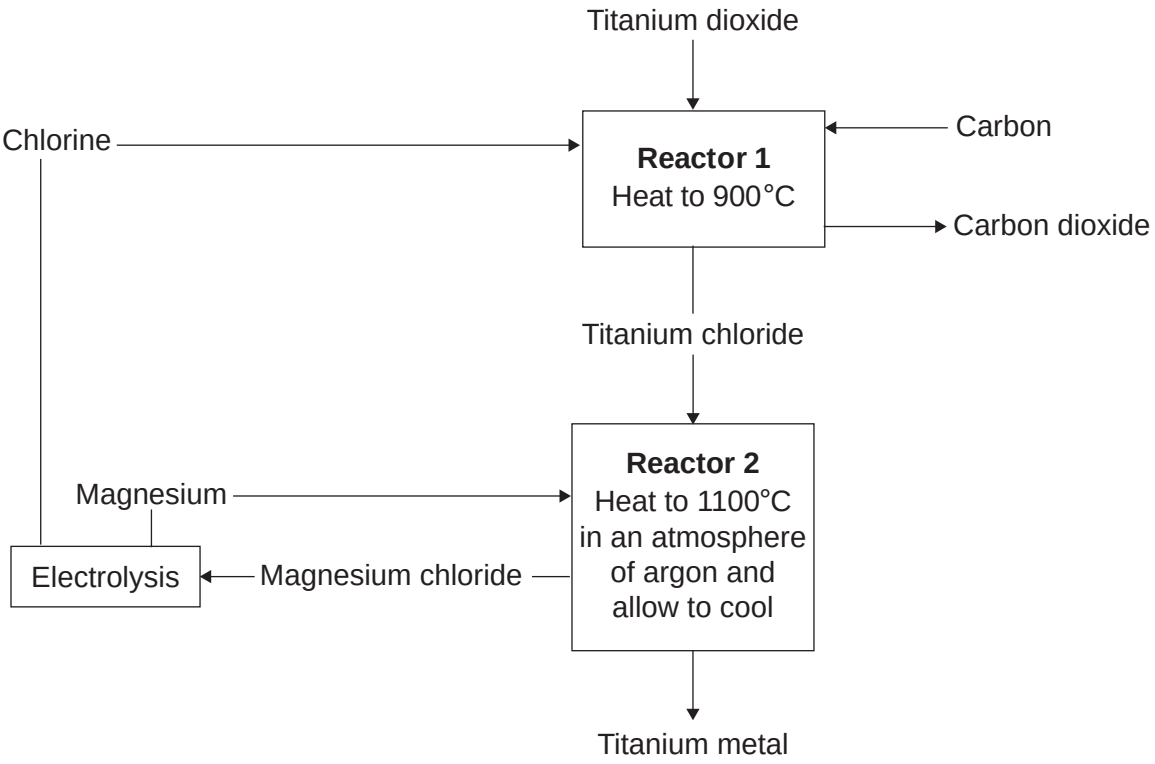
3 $CaO + MgO + 2CO_2$

4 $Ca + Mg + 3CO_2$

4.8.1.1 Pure substances

Question 13

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



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

Give **one** reason why.

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.....

(1 mark)

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

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(1 mark)

4.8.1.1 Pure substances

Question 13 · continued

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

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(2 marks)

2 (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.

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(2 marks)

Question 2 continues on the next page

4.8.1.1 Pure substances

Question 13 · continued

2 (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.

.....

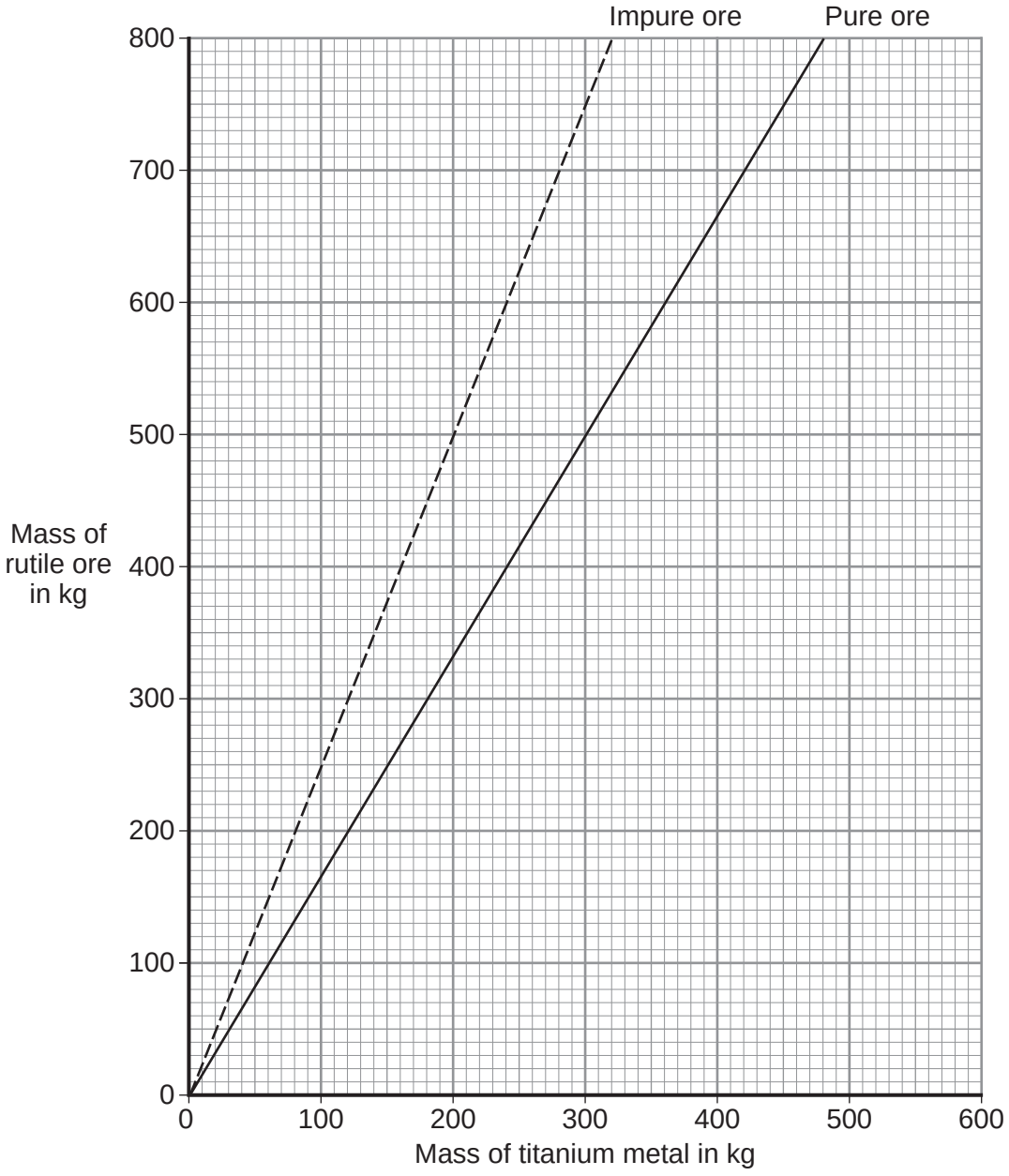
Mass = ... kg

(1 mark)

4.8.1.1 Pure substances

Question 13 · continued

2 (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

4.8.1.1 Pure substances

Question 14

June 2013 | CH1HP | Original Q2 | Legacy

2 Metals are extracted from their ores.

Many copper ores contain only 2% of copper compounds.

2 (a) Copper is now extracted from ores containing a low percentage of copper compounds.

Suggest **two** reasons why.

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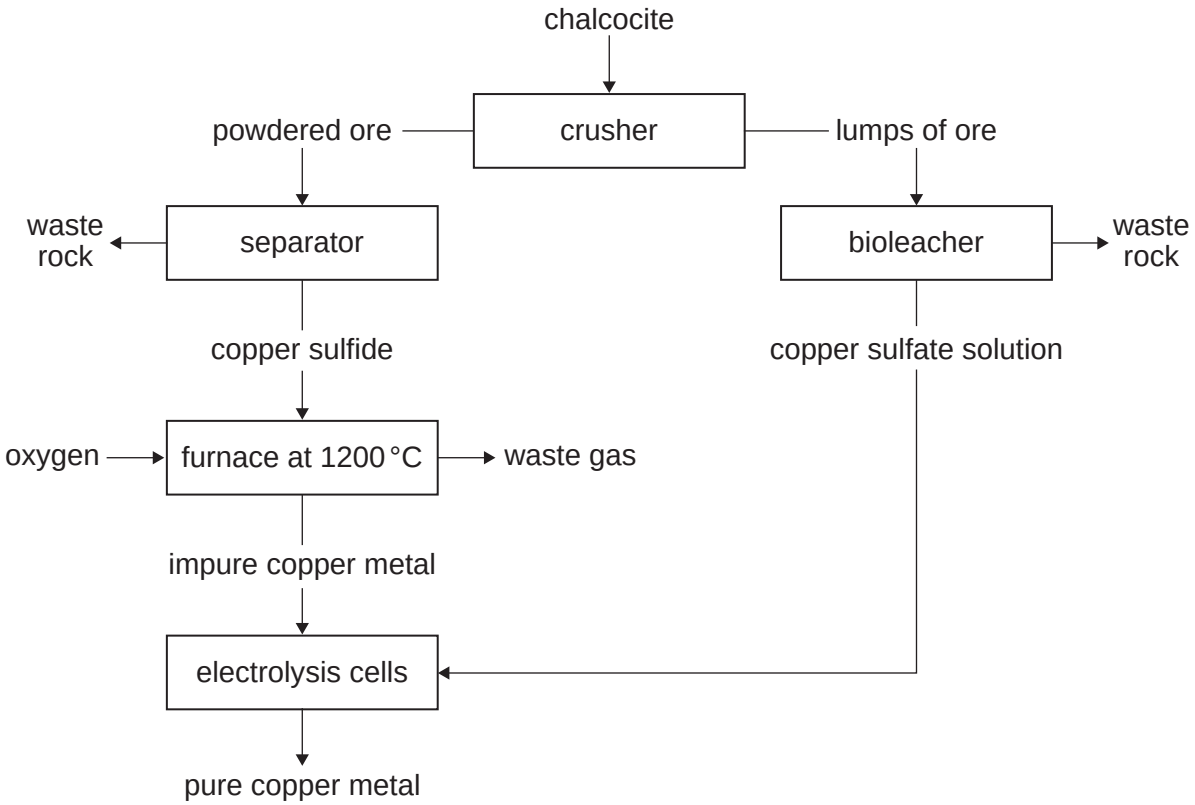
.....

.....

(2 marks)

2 (b) Chalcocite, an ore of copper, contains copper sulfide.
The flow diagram shows how copper metal is extracted from chalcocite.



4.8.1.1 Pure substances

Question 14 · continued

2 (b) (i) Suggest **one** reason why it is difficult to dispose of the waste rock.

.....

.....

(1 mark)

2 (b) (ii) The reaction in the furnace could cause environmental pollution.
Explain how.

.....

.....

.....

.....

(2 marks)

2 (b) (iii) The extraction of pure copper is expensive.
Give **one** reason why.

.....

.....

(1 mark)

2 (b) (iv) Pure copper is produced by electrolysis of copper sulfate solution.

Which electrode do the copper ions move towards?
Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

2 (b) (v) Large areas of land are contaminated with copper compounds.
Phytomining can be used to remove these copper compounds from the land.

What is used in phytomining to remove copper compounds from the land?

.....

.....

(1 mark)

9

4.8.1.1 Pure substances

Question 15

June 2016 | CH1HP | Original Q2 | Legacy

2 This question is about hydrocarbons.

2 (a) Most of the hydrocarbons in crude oil are alkanes.

2 (a) (i) Large alkane molecules can be cracked to produce more useful molecules.

The equation shows the cracking of dodecane.

$$\underset{\text{dodecane}}{C_{12}H_{26}} \longrightarrow \underset{\text{butane}}{C_4H_{10}} + \underset{\text{hexene}}{C_6H_{12}} + \underset{\text{ethene}}{C_2H_4}$$

Give **two** conditions used to crack large alkane molecules.

[2 marks]

1 _____

2 _____

2 (a) (ii) The products hexene and ethene are alkenes.

Complete the sentence.

[1 mark]

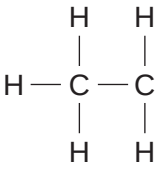
When alkenes react with bromine water the colour changes

from orange to _____ .

2 (a) (iii) Butane (C_4H_{10}) is an alkane.

Complete the displayed structure of butane.

[1 mark]



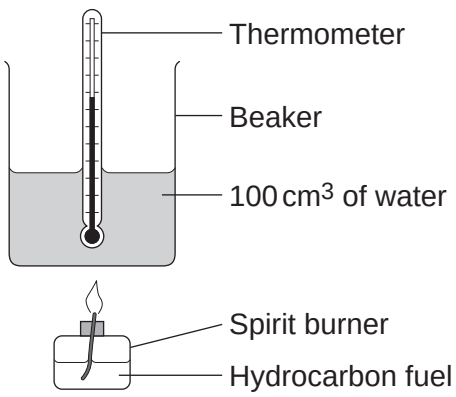
Question 2 continues on the next page

Question 15 · continued

2 (b) A group of students investigated the energy released by the combustion of four hydrocarbon fuels.

Figure 3 shows the apparatus used.

Figure 3



Each hydrocarbon fuel was burned for two minutes.

Table 1 shows the students' results.

Table 1

	After two minutes				
Name and formula of hydrocarbon fuel	**Mass of fuel used in g**	**Temperature increase of water in °C**	**Energy released by fuel in kJ**	**Energy released by 1.0 g of fuel in kJ**	**Relative amount of smoke in the flame**
Hexane, C_6H_{14}	0.81	40	16.80	20.74	very little smoke
Octane, C_8H_{18}	1.10	54	22.68	20.62	some smoke
Decane, $C_{10}H_{22}$	1.20	58	24.36		smoky
Dodecane, $C_{12}H_{26}$	1.41	67	28.14	19.96	very smoky

Question 15 · continued

2 (b) (i) Calculate the energy released by 1.0 g of decane in kJ.

[2 marks]

Energy released = _____ kJ

2 (b) (ii) Suggest **one** improvement to the apparatus, or the use of the apparatus, that would make the temperature increase of the water for each fuel more accurate.

Give a reason why this is an improvement.

[2 marks]

2 (b) (iii) The students noticed that the bottom of the beaker became covered in a black substance when burning these fuels.

Name this black substance.

Suggest why it is produced.

[2 marks]

2 (b) (iv) A student concluded that hexane is the best of the four fuels.

Give **two** reasons why the results in **Table 1** support this conclusion.

[2 marks]

1 _____

2 _____

Question 2 continues on the next page

Question 15 · continued

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

Most car engines use petrol as a fuel.

- Petrol is produced from the fractional distillation of crude oil.
- Crude oil is a mixture of hydrocarbons.
- Sulfur is an impurity in crude oil.

Car engines could be developed to burn hydrogen as a fuel.

- Hydrogen is produced from natural gas.
- Natural gas is mainly methane.

Table 2 shows information about petrol and hydrogen.

Table 2

	Petrol	**Hydrogen**
State of fuel at room temperature	Liquid	Gas
Word equation for combustion of the fuel	petrol + oxygen ⟶ carbon dioxide + water	hydrogen + oxygen ⟶ water
Energy released from combustion of 1 g of the fuel	47 kJ	142 kJ

Describe the **advantages** and **disadvantages** of using hydrogen instead of petrol in car engines.

Use the information given and your knowledge and understanding to answer this question.

[6 marks]

4.8.1.1 Pure substances

Question 16

November 2020 | 8462/1H | Original Q3

0 3 This question is about silver iodide.

Silver iodide is produced in the reaction between silver nitrate solution and sodium iodide solution.

The equation for the reaction is:

$$AgNO_3(aq) + NaI(aq) \rightarrow AgI(s) + NaNO_3(aq)$$

0 3 . 1 A student investigated the law of conservation of mass.

This is the method used.

1. Pour silver nitrate solution into a beaker labelled **A**.
2. Pour sodium iodide solution into a beaker labelled **B**.
3. Measure the masses of both beakers and their contents.
4. Pour the solution from beaker **B** into beaker **A**.
5. Measure the masses of both beakers and their contents again.

Table 3 shows the student's results.

Table 3

	Mass before mixing in g	Mass after mixing in g
Beaker **A** and contents	78.26	108.22
Beaker **B** and contents	78.50	48.54

Explain how the results demonstrate the law of conservation of mass.

You should use data from **Table 3** in your answer.

[2 marks]

4.8.1.1 Pure substances

Question 16 · continued

0 3 . 2 Suggest how the student could separate the insoluble silver iodide from the mixture at the end of the reaction.

[1 mark]

The student purified the separated silver iodide.

This is the method used.

1. Rinse the silver iodide with distilled water.

2. Warm the silver iodide.

0 3 . 3 Suggest **one** impurity that was removed by rinsing with water.

[1 mark]

0 3 . 4 Suggest why the student warmed the silver iodide.

[1 mark]

Question 3 continues on the next page

4.8.1.1 Pure substances

Question 16 · continued

0 3 . 5 Calculate the percentage atom economy for the production of silver iodide in this reaction.

The equation for the reaction is:

$$AgNO_3(aq) + NaI(aq) \rightarrow AgI(s) + NaNO_3(aq)$$

Give your answer to 3 significant figures.

Relative formula masses (M_r): $AgNO_3 = 170$ NaI = 150 AgI = 235 $NaNO_3 = 85$

[4 marks]

Percentage atom economy (3 significant figures) = _____ %

0 3 . 6 Give **one** reason why reactions with a high atom economy are used in industry.

[1 mark]

10

4.8.1.1 Pure substances

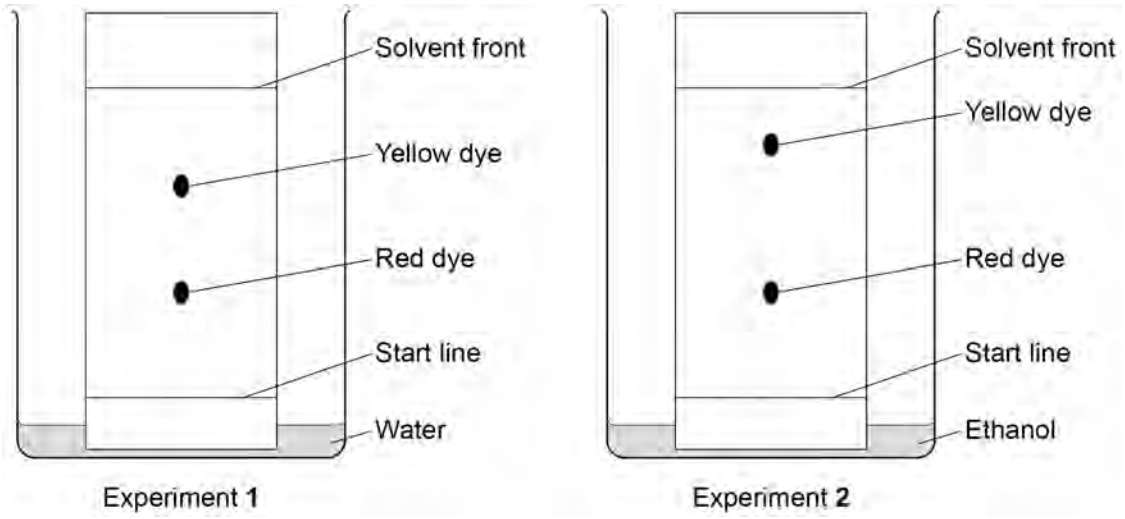
Question 17

June 2024 | 8462/2H | Original Q4

0 4 A student investigated an orange dye (**A**) using paper chromatography.

Figure 4 shows the results of Experiment **1** and Experiment **2** using orange dye **A**.

Figure 4



0 4 . 1 Explain why the yellow dye and red dye travel different distances in Experiment **1**.

Refer to forces of attraction between the dyes and the chromatography paper in your answer.

[2 marks]

4.8.1.1 Pure substances

Question 17 · continued

0 4 . 2 The student used the same type of chromatography paper in Experiment **1** and in Experiment **2**.

Explain why the yellow dye is in different positions in Experiment **1** and in Experiment **2**.

Use **Figure 4**.

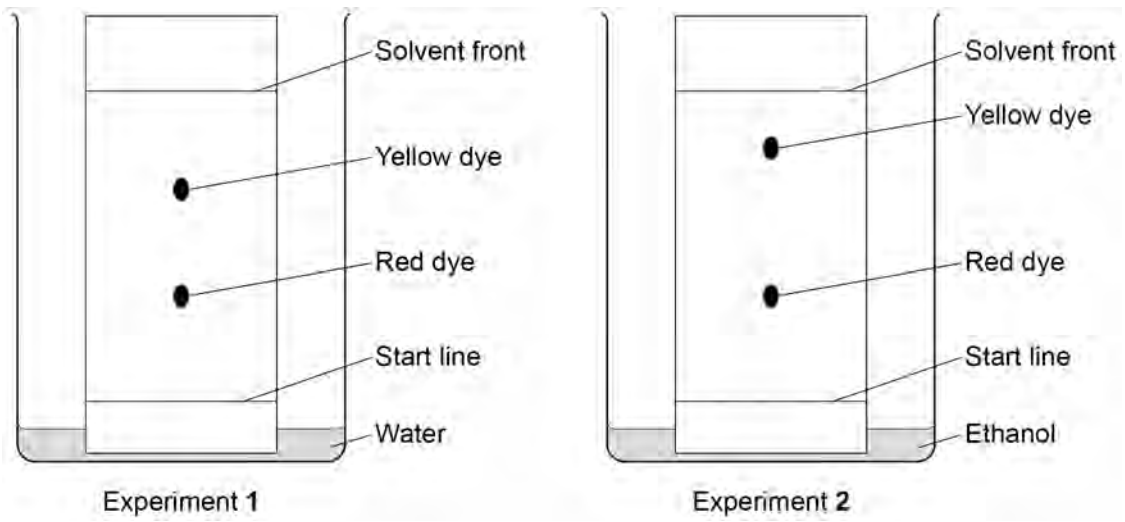
[3 marks]

Question 4 continues on the next page

Figure 4 is repeated below.

Figure 4 shows the results of Experiment **1** and Experiment **2** using orange dye **A**.

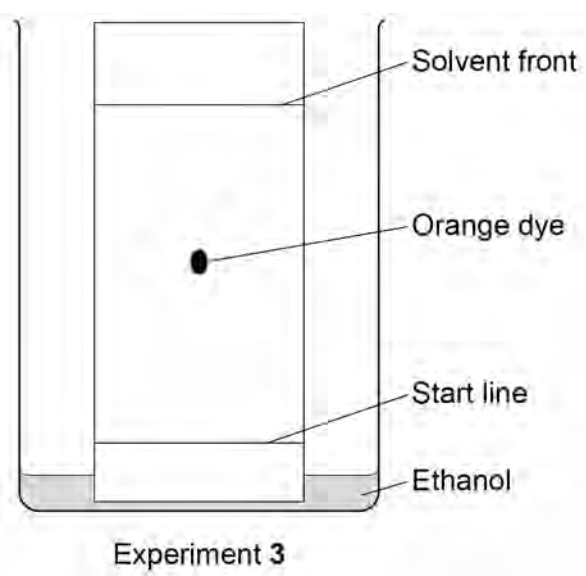
Figure 4



The student investigated a different orange dye (**B**).

Figure 5 shows the results of Experiment **3** using orange dye **B**.

Figure 5



4.8.1.1 Pure substances

Question 17 · continued

0 4 . 3 Compare the purity of the orange dyes **A** and **B**.

Give reasons for your answer.

Use **Figure 4** and **Figure 5**.

[2 marks]

0 4 . 4 The student calculated that the R_f value of the orange dye in the experiment shown in **Figure 5** was 0.48

Calculate the distance moved by the solvent front when the orange dye had moved 5.4 cm.

[3 marks]

Distance moved by solvent front = _____ cm

0 4 . 5 Why is the R_f value of a dye **not** affected by how far the solvent front is allowed to travel?

[1 mark]

4.8.1.1 Pure substances

Question 17 · continued

0 4 . 6 Another type of chromatography is called gas chromatography.

Gas chromatography is an instrumental method of chemical analysis.

Scientists tested the orange dyes using gas chromatography.

Suggest **two** advantages of using the instrumental method of gas chromatography rather than paper chromatography.

[2 marks]

1 _____

_____

2 _____

_____

13