AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.8.1.1

Pure substances

Past-paper questions

Tier	**Foundation**
Question groups	**18**
Available paper years	**2007–2025**

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 | 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.

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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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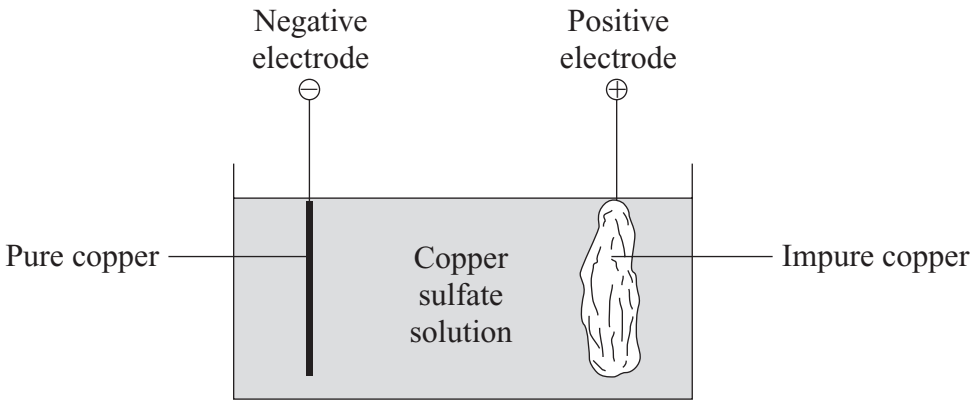
(2 marks)

4.8.1.1 Pure substances

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?

.....

(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.

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(3 marks)

10

4.8.1.1 Pure substances

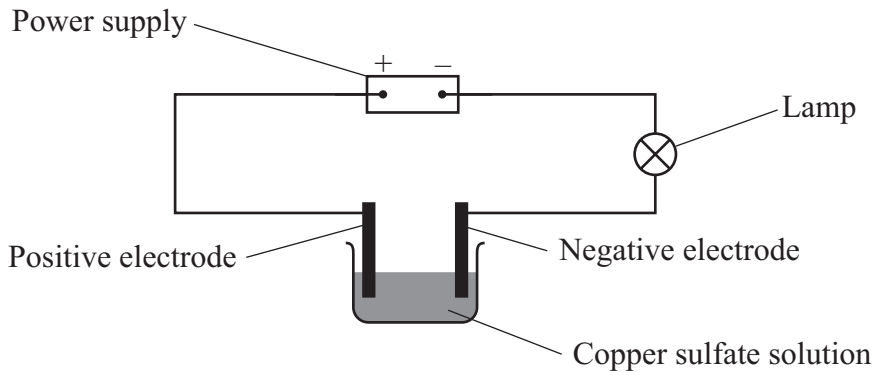
Question 02

June 2008 | CHY2F | Original Q8 | Legacy

8 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.

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

.....

.....

(1 mark)

8 (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

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

(1 mark)

8 (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 .....

.....

2 .....

.....

(2 marks)

8 (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

March 2009 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

Impure iron is produced in a blast furnace by reducing the iron compound found in one of its ores.

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

A carbon

B cast iron

C iron

D iron oxide

The main ore from which iron is extracted contains the compound . . . **1** . . . .

This is reduced in the blast furnace by reacting it with . . . **2** . . . .

The metal produced from the blast furnace contains about 96% . . . **3** . . . .

The product is brittle and is known as . . . **4** . . . .

4.8.1.1 Pure substances

Question 04

June 2010 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

The table shows the composition and melting points of four alloys, **A**, **B**, **C** and **D**.

Alloy	Melting point in °C	Percentage composition (%)				
		Tin	Indium	Bismuth*	Lead*	Cadmium*
A	100	24.0	0	49.0	27.0	0
B	62	16.5	51.0	32.5	0	0
C	70	13.0	0	50.0	27.0	10.0
D	47	8.3	19.1	44.7	22.6	5.3

Toxic substances are marked with *.

Match alloys, **A**, **B**, **C** and **D**, with the numbers **1–4**.

1 It has the highest melting point.

2 It is made up from the largest number of substances.

3 It contains the least bismuth.

4 It contains the largest percentage of toxic substances.

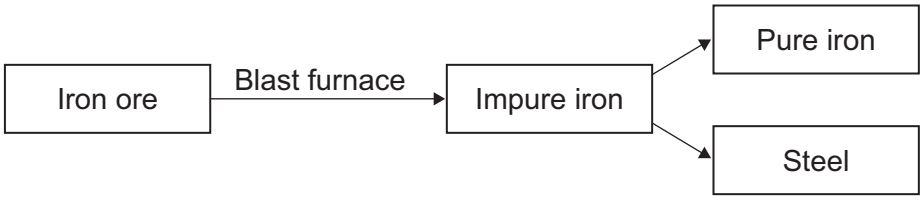
4.8.1.1 Pure substances

Question 05

June 2010 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

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



8A 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.

8B 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.

8C 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.

8D 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.

4.8.1.1 Pure substances

Question 06

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.

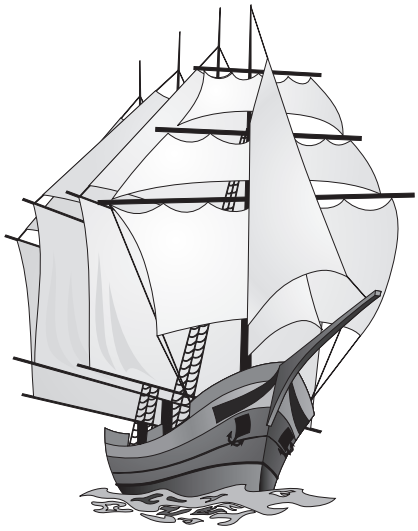
END OF TEST

4.8.1.1 Pure substances

Question 07

6 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 07 · continued

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

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

.....

.....

(1 mark)

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

.....

.....

(1 mark)

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

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

.....

(1 mark)

6 (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)

6 (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)

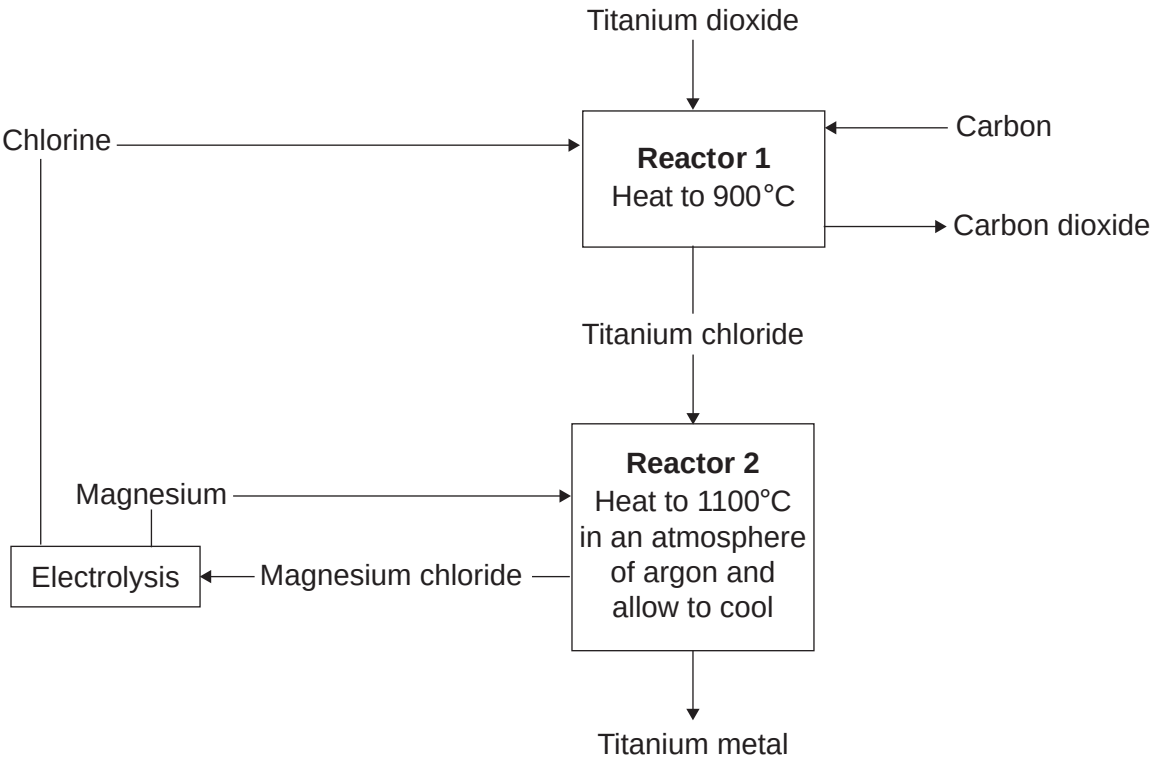
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4.8.1.1 Pure substances

Question 08

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)

4.8.1.1 Pure substances

Question 08 · 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

4.8.1.1 Pure substances

Question 08 · 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.

.....

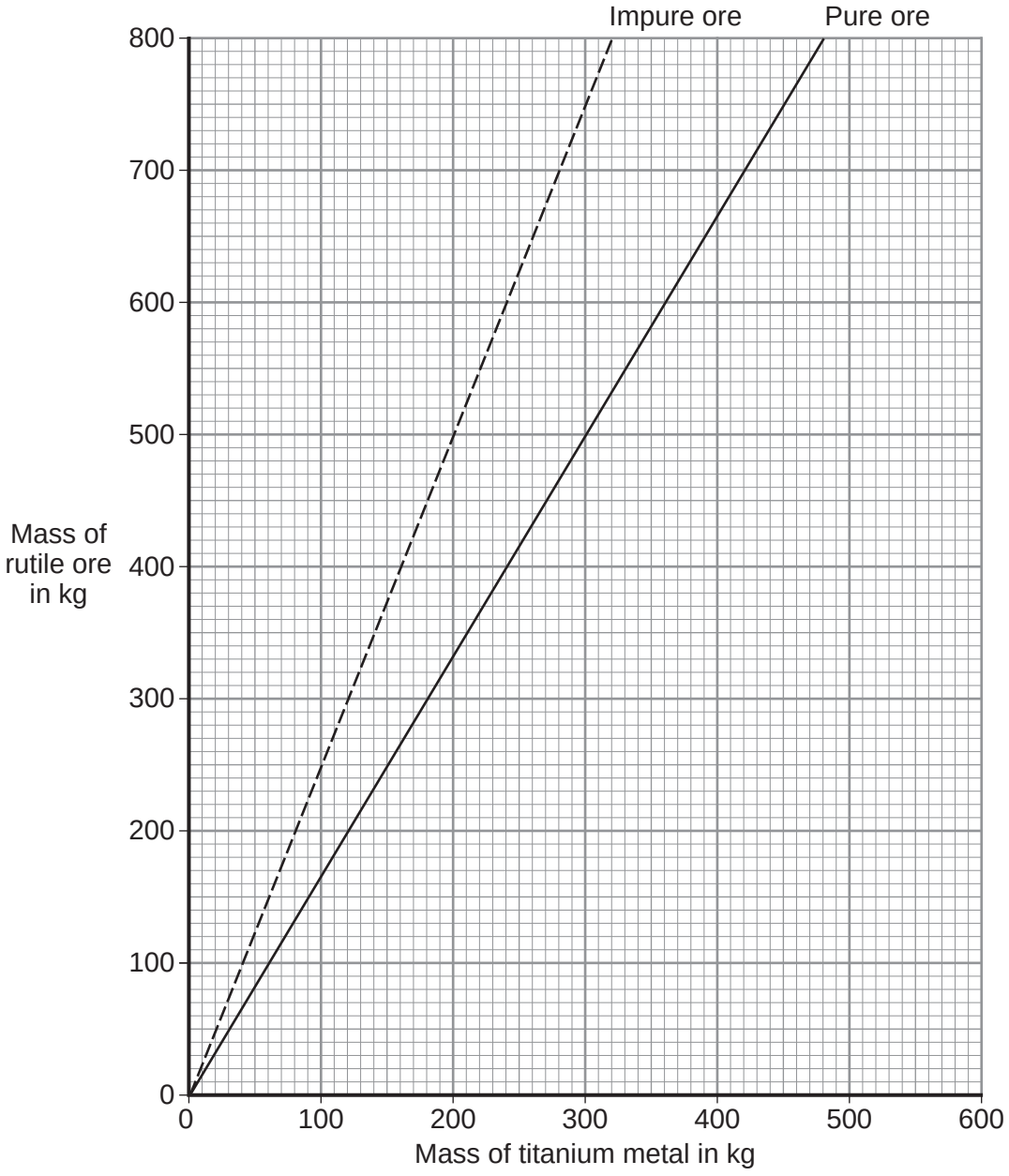
Mass = ... kg

(1 mark)

4.8.1.1 Pure substances

Question 08 · 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

4.8.1.1 Pure substances

Question 09

June 2013 | CH1FP | Original Q7 | Legacy

7 Metals are extracted from their ores.

Many copper ores contain only 2% of copper compounds.

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

Suggest **two** reasons why.

.....

.....

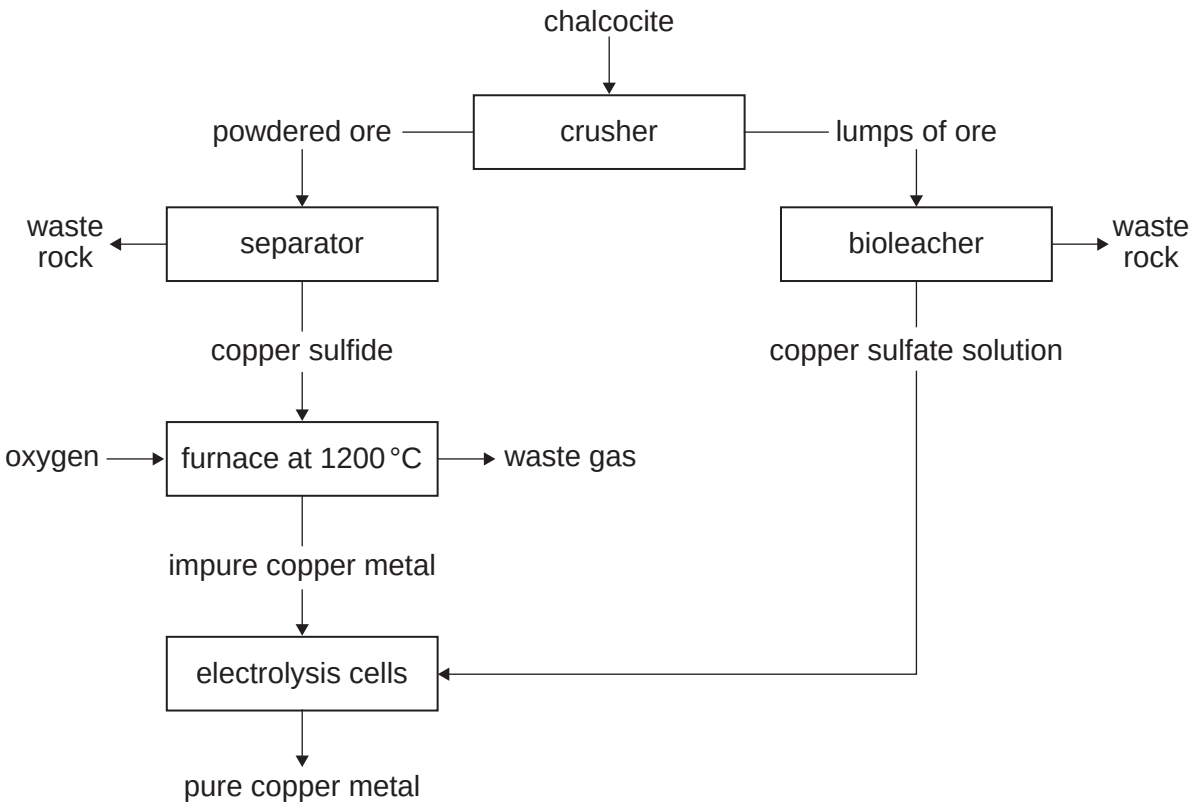
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(2 marks)

7 (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 09 · continued

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

.....

.....

(1 mark)

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

.....

.....

.....

.....

(2 marks)

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

.....

.....

(1 mark)

7 (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)

7 (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 10

June 2016 | CH1FP | Original Q5 | Legacy

5 This question is about hydrocarbons.

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

5 (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 _____

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

Complete the sentence.

[1 mark]

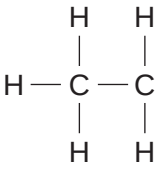
When alkenes react with bromine water the colour changes

from orange to _____ .

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

Complete the displayed structure of butane.

[1 mark]



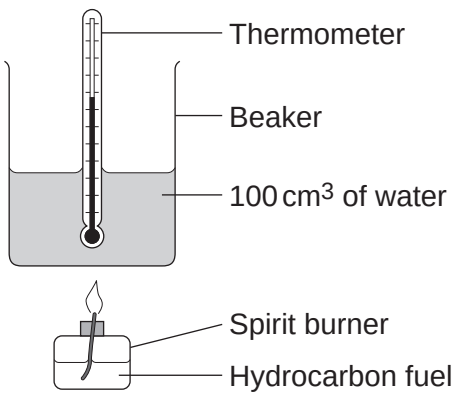
Question 5 continues on the next page

Question 10 · continued

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

Figure 12 shows the apparatus used.

Figure 12



Each hydrocarbon fuel was burned for two minutes.

Table 2 shows the students' results.

Table 2

	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

4.8.1.1 Pure substances

Question 10 · continued

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

[2 marks]

Energy released = _____ kJ

5 (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]

5 (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]

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

Give **two** reasons why the results in **Table 2** support this conclusion.

[2 marks]

1 _____

2 _____

Question 5 continues on the next page

Question 10 · continued

5 (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 3 shows information about petrol and hydrogen.

Table 3

	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 11

November 2020 | 8462/1F | Original Q10

1 0 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:

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

1 0 . 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 7 shows the student's results.

Table 7

	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 7** in your answer.

[2 marks]

4.8.1.1 Pure substances

Question 11 · continued

10.2 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.

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

[1 mark]

10.4 Suggest why the student warmed the silver iodide.

[1 mark]

Question 10 continues on the next page

4.8.1.1 Pure substances

Question 11 · continued

1 0 . 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) = _____ %

1 0 . 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 12

November 2021 | 8462/2F | Original Q7

0 7 This question is about organic compounds.

0 7 . 1 Butane is an alkane with small molecules.

Complete the sentence.

Choose the answer from the box.

[1 mark]

fertiliser	**formulation**	**fuel**

Butane can be used as a _____.

0 7 . 2 Poly(propene) is a polymer.

What is the name of the monomer used to produce poly(propene)?

[1 mark]

Tick (✓) **one** box.

- Propane ☐
- Propanoic acid ☐
- Propanol ☐
- Propene ☐

Question 12 · continued

Ethene and steam react to produce ethanol.

The equation for the reversible reaction is:

ethene + steam ⇌ ethanol

0 7 . 3 The reaction produces a maximum theoretical mass of 400 kg of ethanol from 243 kg of ethene and 157 kg of steam.

A company produces 380 kg of ethanol from 243 kg of ethene and 157 kg of steam.

The percentage yield of ethanol is less than 100%

Calculate the percentage yield of ethanol.

Use the equation:

$$\text{percentage yield of ethanol} = \frac{\text{mass of ethanol actually made}}{\text{maximum theoretical mass of ethanol}} \times 100$$

[2 marks]

Percentage yield = _____ %

0 7 . 4 What are **two** possible reasons why the percentage yield of ethanol is less than 100%?

[2 marks]

Tick (✓) **two** boxes.

- Ethanol is the only product of the reaction. ☐
- Ethanol is very unreactive. ☐
- Some ethanol changes back into ethene and steam. ☐
- Some ethanol escapes from the apparatus. ☐
- Some ethanol reacts with steam. ☐

Question 12 · continued

0 7 . 5 Ethanol burns in oxygen.

Balance the equation for the reaction.

[1 mark]

$$C_2H_5OH + ___ O_2 \rightarrow 3H_2O + 2CO_2$$

0 7 . 6 Two processes for producing ethanol are:

- fermentation
- hydration (reacting ethene with steam).

Table 5 shows information about the processes.

Table 5

Feature	Process	
	Fermentation	**Hydration**
Raw material	sugar	crude oil
Energy usage	low	high
Rate of reaction	slow	fast
Purity of ethanol	15%	98%

Give **two** advantages and **two** disadvantages of using fermentation to produce ethanol.

[4 marks]

Advantage of fermentation 1 _____

_____

Advantage of fermentation 2 _____

_____

Disadvantage of fermentation 1 _____

_____

Disadvantage of fermentation 2 _____

_____

11

4.8.1.1 Pure substances

Question 13

June 2022 | 8462/1F | Original Q2

0 2 This question is about elements, compounds and mixtures.

0 2 . 1 Which type of substance is hydrogen?

[1 mark]

Tick (✓) **one** box.

Element ☐

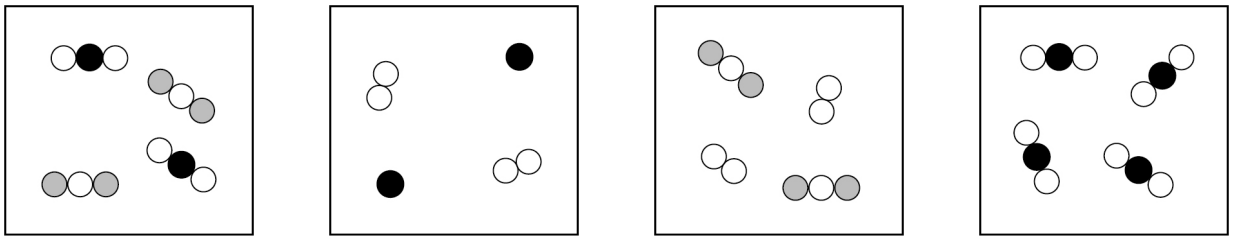
Compound ☐

Mixture ☐

The diagrams in **Figure 2** represent different substances.

○ ● and ○ represent atoms of three different elements.

Figure 2



A **B** **C** **D**

Use **Figure 2** to answer questions **02.2** and **02.3**.

0 2 . 2 Which diagram represents a mixture of compounds?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 3 Which diagram represents a mixture of elements?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 13 · continued

Substances can be separated from mixtures by using different methods.

0 2 . 4 Complete the sentence.

[1 mark]

Sand can be separated from a mixture of sand and water by

_____.

A mixture of four liquids was fractionally distilled.

Figure 3 shows the apparatus used.

Figure 3

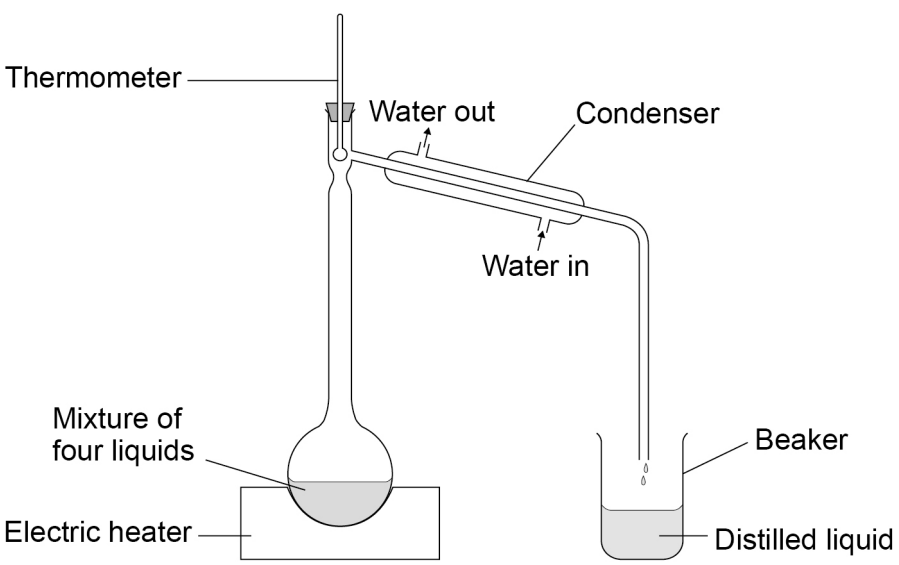


Table 2 shows the boiling points of the four liquids in the mixture.

Table 2

Liquid	Boiling point in °C
A	97
B	138
C	78
D	118

4.8.1.1 Pure substances

Question 13 · continued

0 2 . 5 Which liquid in **Table 2** would distil and be collected in the beaker first?

[1 mark]

Liquid _____

0 2 . 6 Suggest what would happen to the temperature of the water as the water flows through the condenser.

[1 mark]

_____

_____

0 2 . 7 Describe how to obtain sodium chloride crystals from sodium chloride solution by crystallisation.

[2 marks]

_____

_____

_____

_____

8

4.8.1.1 Pure substances

Question 14

June 2022 | 8462/2F | Original Q1

0 1 This question is about water.

A student investigated pure water.

The student measured:

- the boiling point of pure water
- the pH of pure water.

0 1 . 1 Complete the sentences.

Choose answers from the box.

[2 marks]

0	**4**	**7**	**10**	**25**	**100**

Pure water has a boiling point of _____ °C.

Pure water has a pH of _____.

0 1 . 2 What could the student use to measure the pH of pure water?

[1 mark]

_____

_____

4.8.1.1 Pure substances

Question 14 · continued

A different student investigated sea water.

Sea water contains dissolved solids.

This is the method used.

1. Measure a 50 cm^3 sample of the sea water.
2. Heat the sample until all the water has evaporated.
3. Measure the mass of solid that remains.
4. Repeat steps 1 to 3 three more times.

0 1 . 3 Which **two** pieces of equipment were needed in this investigation?

[2 marks]

Tick (✓) **two** boxes.

- Balance ☐
- Measuring cylinder ☐
- Ruler ☐
- Thermometer ☐
- Timer ☐

Question 1 continues on the next page

Question 14 · continued

0 1 . 4 **Table 1** shows the results.

Table 1

Sea water sample	Mass of solid that remained in grams
1	1.73
2	1.70
3	1.75
4	1.78

Calculate the mean mass of solid that remained.

[2 marks]

Mean mass = _____ g

0 1 . 5 A 50 cm^3 sample of sea water from a different source contained 1.50 g of dissolved solids.

Calculate the mass of dissolved solids in 1000 cm^3 of this sea water.

[2 marks]

Mass = _____ g

4.8.1.1 Pure substances

Question 14 · continued

Sodium chloride is a dissolved solid in sea water.

Sodium chloride contains sodium ions and chloride ions.

0 1 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

crimson	**lilac**	**yellow**

The student tested sea water for sodium ions using a flame test.

The colour of the flame was _____.

0 1 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

brown	**green**	**white**

The student tested sea water for chloride ions by adding nitric acid and silver nitrate solution.

The colour of the precipitate formed was _____.

11

4.8.1.1 Pure substances

Question 15

June 2023 | 8462/1F | Original Q4

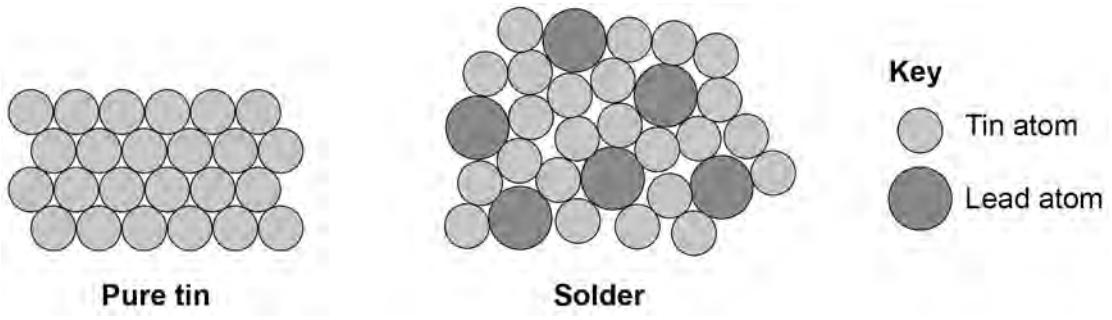
0 4 This question is about alloys.

Solders are alloys of tin and lead.

Different solders have different percentages of tin and lead.

Figure 4 shows the arrangement of atoms in pure tin and in a solder.

Figure 4



0 4 . 1 The solder in **Figure 4** has 6 lead atoms for every 24 tin atoms.

Determine the percentage of atoms that are lead atoms in the solder in **Figure 4**.

[3 marks]

Percentage of lead atoms = _____ %

0 4 . 2 Explain why solder is harder than pure tin.

Complete the sentences.

Use **Figure 4**.

[2 marks]

In solder the layers are distorted.

This is because the atoms of tin and lead have different _____.

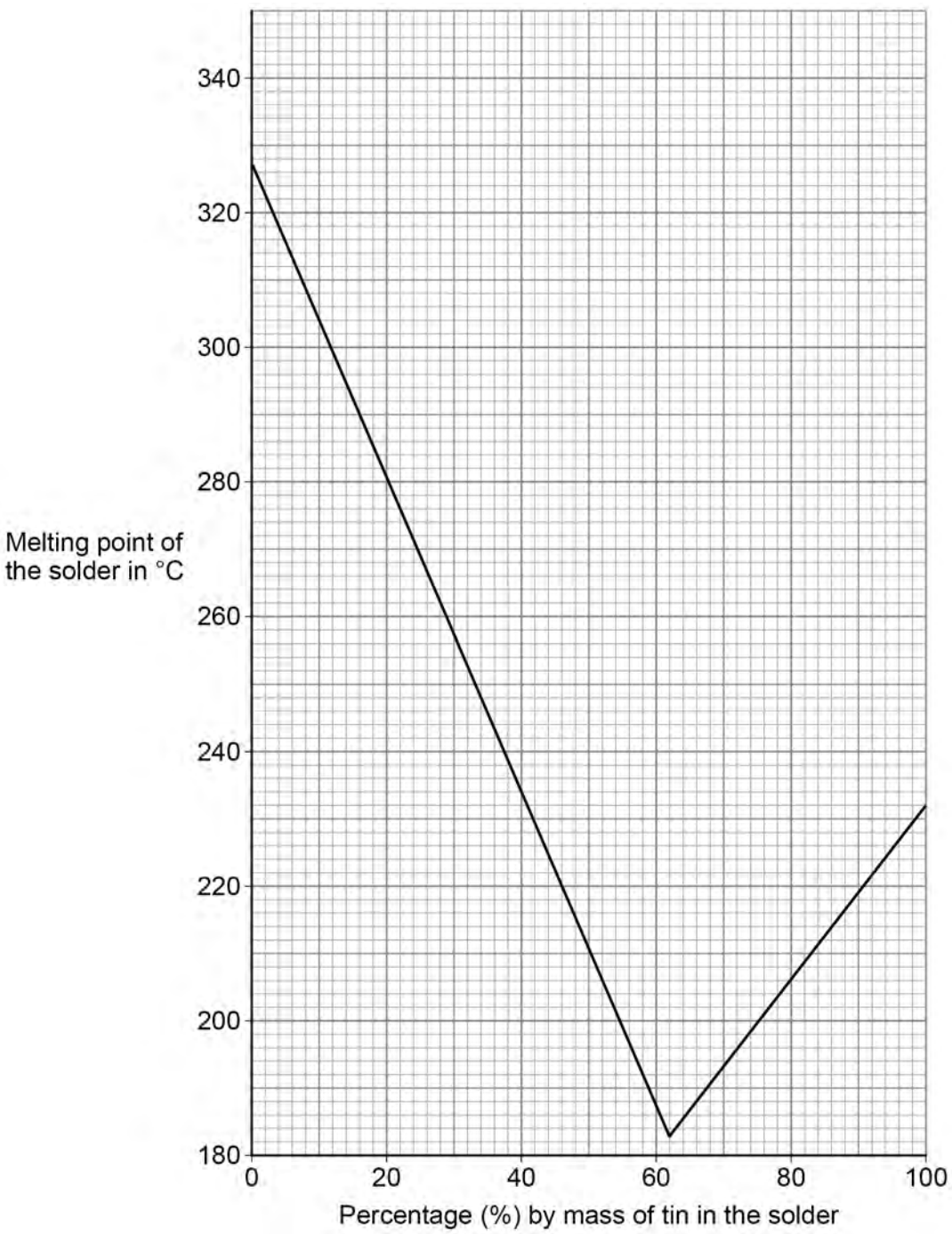
Therefore the layers cannot easily _____.

4.8.1.1 Pure substances

Question 15 · continued

Figure 5 shows how the melting point of the solder changes with the percentage by mass of tin in the solder.

Figure 5



Question 15 · continued

0 4 . 3 Describe what happens to the melting point of the solder as the percentage by mass of tin increases.

Use data from **Figure 5**.

[3 marks]

0 4 . 4 What is the melting point of pure tin?

Use **Figure 5**.

[1 mark]

Melting point of pure tin = _____ °C

0 4 . 5 What happens to the atoms in pure tin as the tin melts?

[1 mark]

Tick (✓) **one** box.

- The atoms gain energy and their arrangement becomes less ordered. ☐
- The atoms gain energy and their arrangement becomes more ordered. ☐
- The atoms lose energy and their arrangement becomes less ordered. ☐
- The atoms lose energy and their arrangement becomes more ordered. ☐

10

4.8.1.1 Pure substances

Question 16

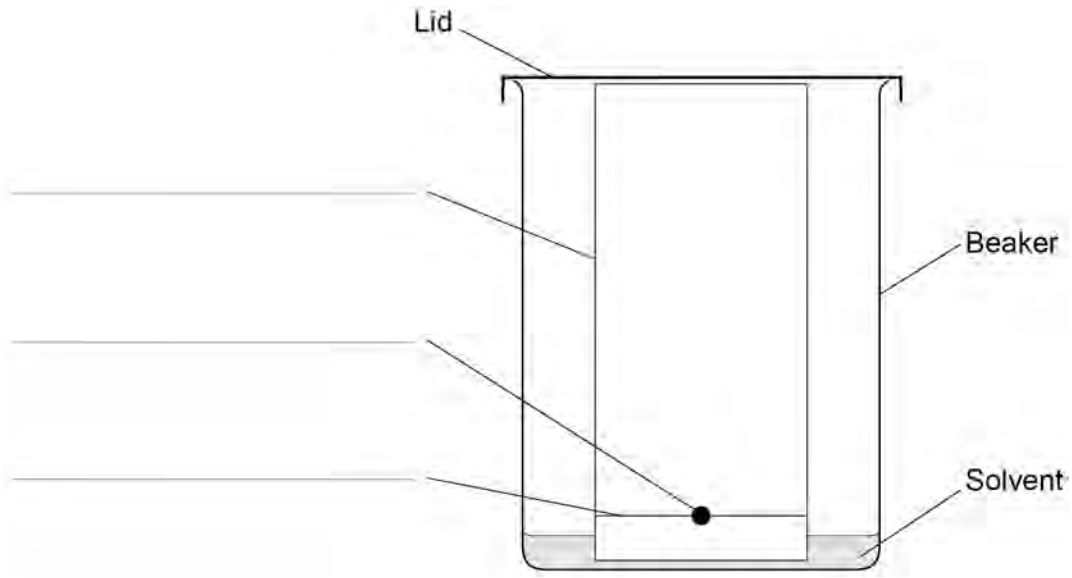
June 2023 | 8462/2F | Original Q3

0 3 This question is about chromatography.

A student investigated an orange dye using paper chromatography.

0 3 . 1 **Figure 3** shows the apparatus at the start of the investigation.

Figure 3



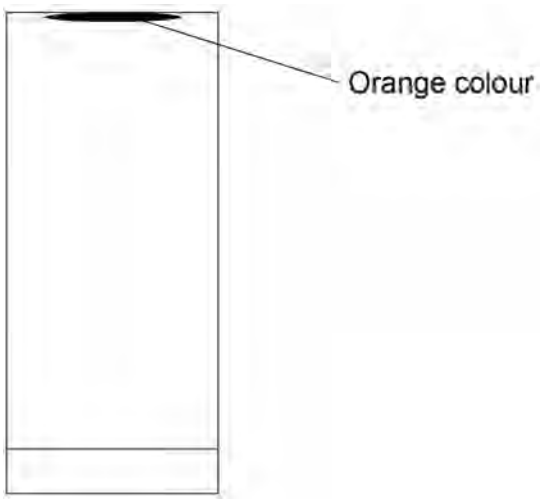
Complete the labels on **Figure 3**.

[3 marks]

Question 16 · continued

0 3 . 2 **Figure 4** shows the results at the end of the investigation.

Figure 4



The student made a mistake in the investigation.

What mistake did the student make to produce the results shown in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

Left the investigation for too long ☐

Used a lid on the beaker ☐

Used a solvent which did not dissolve the dye ☐

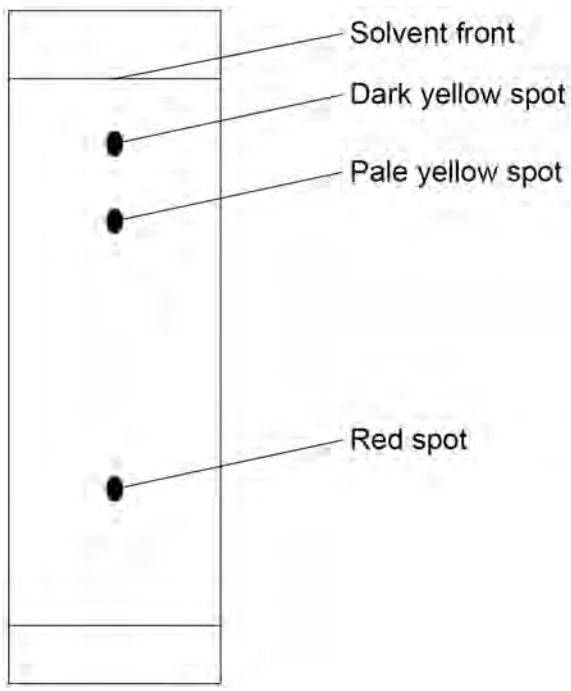
Question 3 continues on the next page

Question 16 · continued

A different student did the investigation correctly.

Figure 5 shows the results.

Figure 5



0 3 . 3 How do the results in **Figure 5** show that the orange dye is **not** a pure substance?

[1 mark]

Question 16 · continued

0 3 . 4 Determine the R_f value for the red spot.

You should measure:

- the distance moved by the red spot
- the distance moved by the solvent.

Use **Figure 5** and the equation:

$$R_f = \frac{\text{distance moved by red spot}}{\text{distance moved by solvent}}$$

[4 marks]

Distance moved by red spot _____ cm

Distance moved by solvent _____ cm

_____

_____

R_f = _____

0 3 . 5 Which spot had the greatest R_f value?

Use **Figure 5**.

[1 mark]

Tick (✓) **one** box.

Dark yellow spot ☐

Pale yellow spot ☐

Red spot ☐

10

4.8.1.1 Pure substances

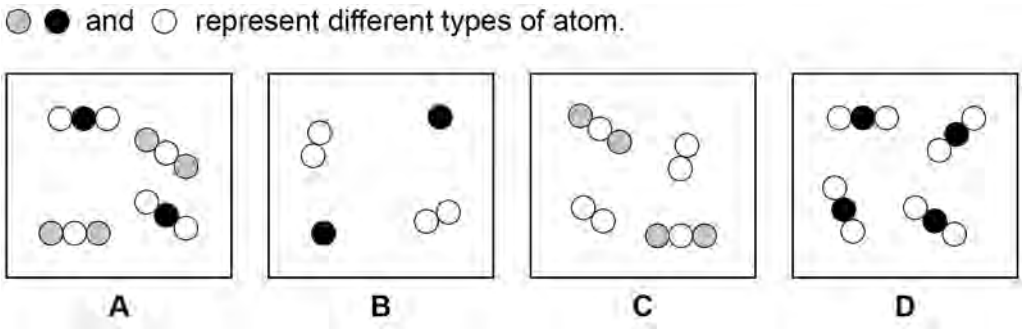
Question 17

June 2024 | 8462/1F | Original Q1

0 1 This question is about elements, compounds and mixtures.

Figure 1 shows diagrams which represent the atoms and molecules in different substances.

Figure 1



0 1 . 1 Which diagram in **Figure 1** represents a pure compound?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

0 1 . 2 Which diagram in **Figure 1** represents a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

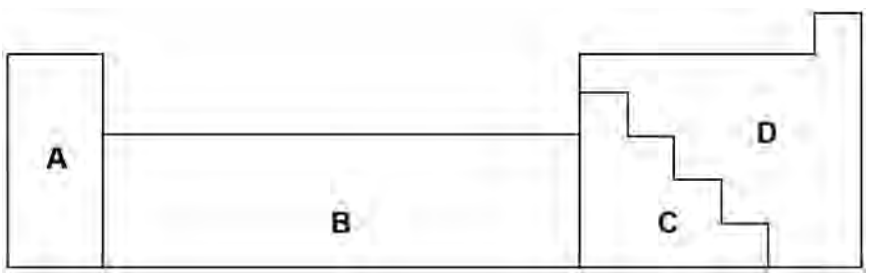
Question 1 continues on the next page

0 1 . 3 Elements are metals or non-metals.

Figure 2 shows an outline of the periodic table.

The periodic table is divided into sections.

Figure 2



Where are metals found in the periodic table?

[1 mark]

Tick (✓) **one** box.

Section **A** only ☐

Sections **A**, **B** and **C** ☐

Sections **B**, **C** and **D** ☐

Section **D** only ☐

Question 17 · continued

0 1 . 4 Which **two** of the following are typical properties of a transition metal?

[2 marks]

Tick (✓) **two** boxes.

Can be bent and shaped	☐
Good conductor of electricity	☐
Low density	☐
Low melting point	☐
Poor conductor of heat	☐

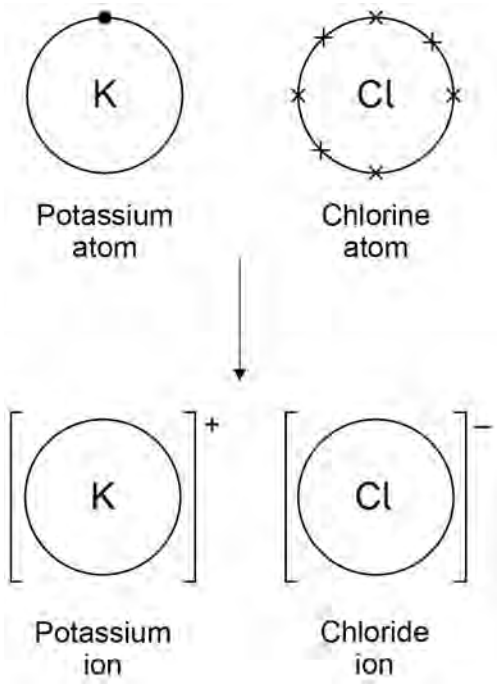
0 1 . 5 Potassium and chlorine react to produce potassium chloride.

An atom of potassium loses an electron to form a potassium ion.

An atom of chlorine gains an electron to form a chloride ion.

Complete the dot and cross diagram.

[2 marks]



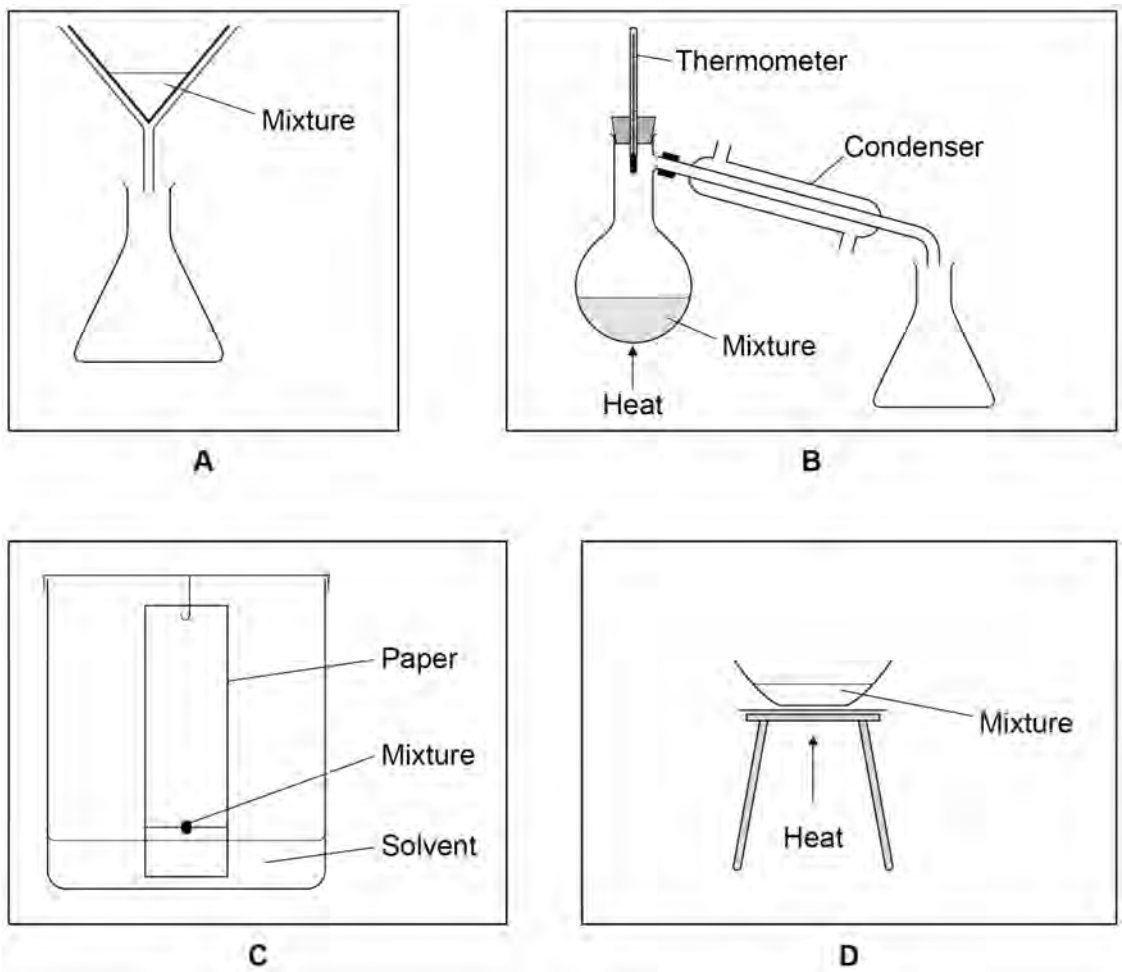
4.8.1.1 Pure substances

Question 17 · continued

Mixtures are separated by different methods.

Figure 3 shows the apparatus for separating four different types of mixture.

Figure 3



4.8.1.1 Pure substances

Question 17 · continued

0 1 . 6 Which apparatus could be used to collect water from sodium chloride solution?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 7 Which apparatus shows filtration?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

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4.8.1.1 Pure substances

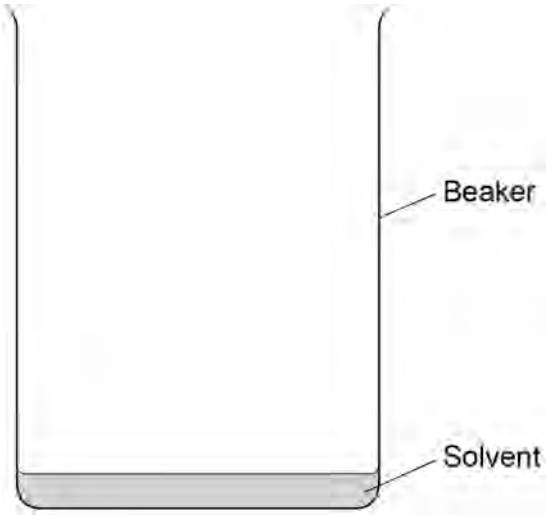
Question 18

June 2025 | 8462/2F | Original Q5

0 5 This question is about chromatography.

Figure 4 shows some equipment used for paper chromatography.

Figure 4



0 5 . 1 Complete **Figure 4** to show how the equipment can be used to separate the dyes in an ink.

You should draw and **label**:

- a piece of chromatography paper **in the beaker**
- a start line on the chromatography paper
- a spot of the ink on the chromatography paper at the **start** of the experiment.

[3 marks]

0 5 . 2 Why should a pencil be used to draw the start line on the chromatography paper?

[1 mark]

Question 18 · continued

The R_f value of a dye was 0.80

A spot of the dye moved a distance of 5.2 cm.

0 5 . 3 Calculate the distance moved by the solvent.

Use the equation:

$$R_f = \frac{\text{distance moved by spot}}{\text{distance moved by solvent}}$$

[3 marks]

Distance moved by solvent = _____ cm

0 5 . 4 How is the distance moved by the spot of the dye measured?

[1 mark]

Tick (✓) **one** box.

From the start line to the bottom of the spot ☐

From the start line to the centre of the spot ☐

From the start line to the top of the spot ☐

Question 5 continues on the next page

Question 18 · continued

0 5 . 5 Which **two** changes could produce a different R_f value for this dye?

[2 marks]

Tick (✓) **two** boxes.

- Use a different beaker. ☐
- Use a different length of time. ☐
- Use a different sized spot of dye. ☐
- Use a different solvent. ☐
- Use a different type of chromatography paper. ☐

0 5 . 6 A different dye is a pure substance.

How many spots will this dye produce during chromatography?

[1 mark]

_____

0 5 . 7 Which is an advantage of using gas chromatography instead of paper chromatography?

Choose the answer from the box.

[1 mark]

less sensitive	**more accurate**	**slower**

Gas chromatography is _____.

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