

Please write clearly in block capitals.

Centre number

--	--	--	--	--

Candidate number

--	--	--	--

Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 1F

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator
- the periodic table (enclosed).

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



J U N 2 2 8 4 6 4 C 1 F 0 1

0 1

This question is about Group 1 elements.

0 1 . 1

What are the Group 1 elements known as?

[1 mark]

Tick (✓) **one** box.

Alkali metals

☐

Halogens

☐

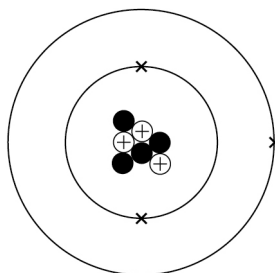
Noble gases

☐

0 1 . 2

Figure 1 shows a lithium atom.

Figure 1



What is the number of electrons and neutrons in the atom of lithium?

[2 marks]

Number of electrons _____

Number of neutrons _____

0 1 . 3

What is the relative charge on a lithium ion?

[1 mark]

Tick (✓) **one** box.

+1

☐

0

☐

-1

☐

0 1 . 4

Lithium is heated and then cooled in an experiment.

Lithium solid $\xrightarrow{\text{Stage 1}}$ Lithium liquid $\xrightarrow{\text{Stage 2}}$ Lithium solid

Two physical changes happen in the experiment.

Draw **one** line from each stage to the physical change that happens in that stage.**[2 marks]****Stage****Physical change**

Boiling

Condensing

Dissolving

Freezing

Melting

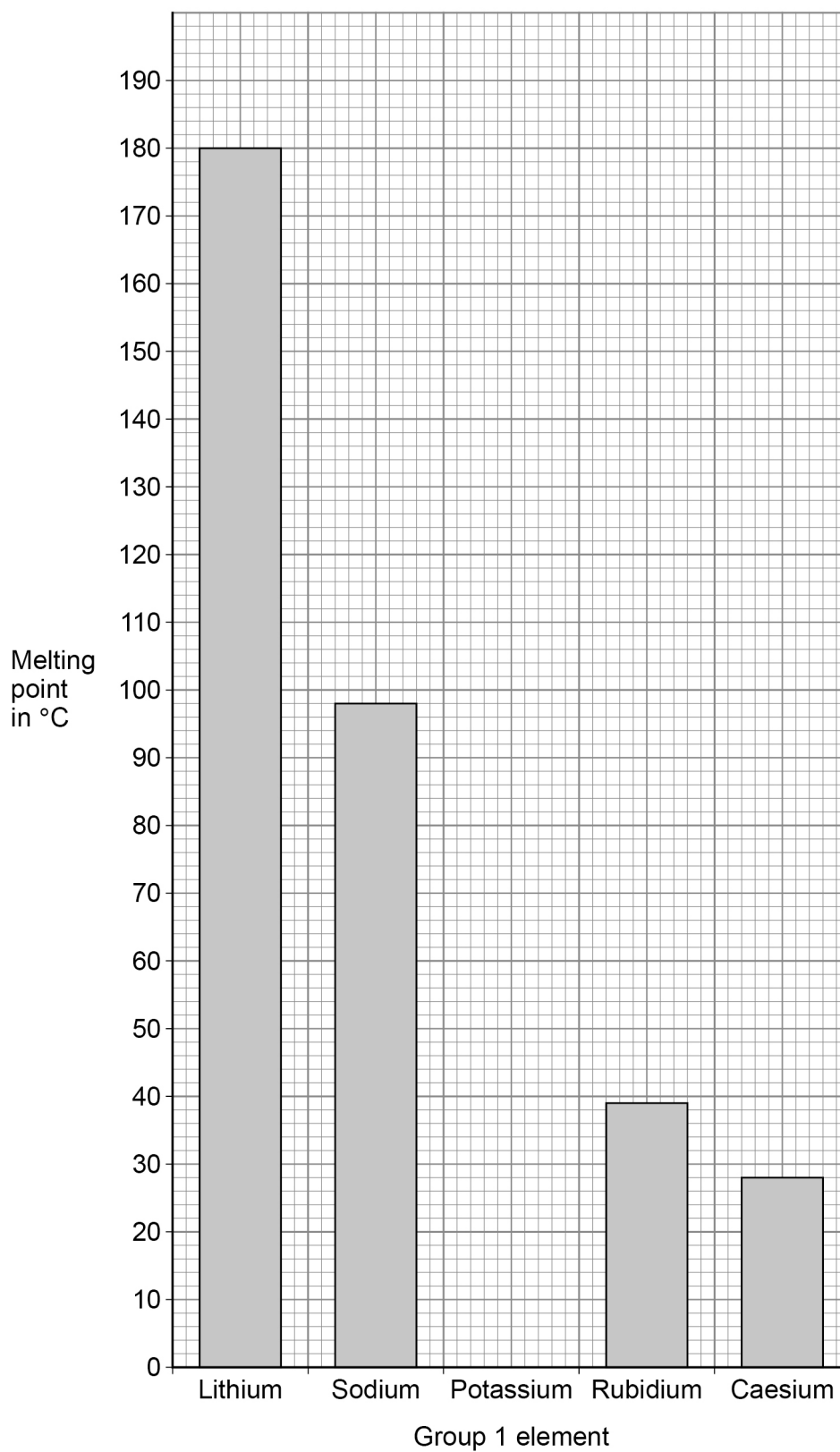
Stage 1

Stage 2

Question 1 continues on the next page**Turn over ►**

Figure 2 represents the melting points of some Group 1 elements.

Figure 2



0 1 . 5 What is the melting point of caesium?

Use **Figure 2**.

[1 mark]

Melting point = _____ °C

0 1 . 6 The melting point of potassium is 63 °C

Draw a bar for the melting point of potassium on **Figure 2**.

[1 mark]

0 1 . 7 Describe the trend of the melting points of the Group 1 elements in **Figure 2**.

[3 marks]

0 1 . 8 The boiling point of sodium is 883 °C

What is the state of sodium at 150 °C?

Use **Figure 2**.

[1 mark]

Tick (✓) **one** box.

Gas	☐
Liquid	☐
Solid	☐

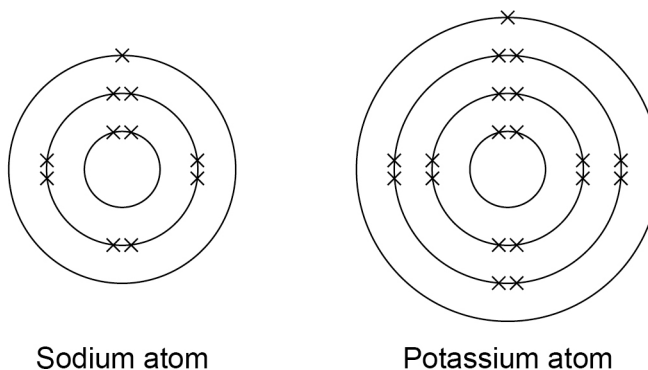
Turn over ►



0 1 . 9

Figure 3 represents the electronic structure of a sodium atom and of a potassium atom.

Figure 3



Complete the sentence.

Choose the answer from the box.

[1 mark]

gains an electron

loses an electron

shares an electron

Potassium is more reactive than sodium because potassium more easily _____.

13



0 2

This question is about hydrogen chloride and sodium hydroxide.

0 2 . 1

A chlorine atom has 7 electrons in the outer shell.

A hydrogen atom has 1 electron in the outer shell.

Figure 4 represents part of a dot and cross diagram for a molecule of hydrogen chloride.

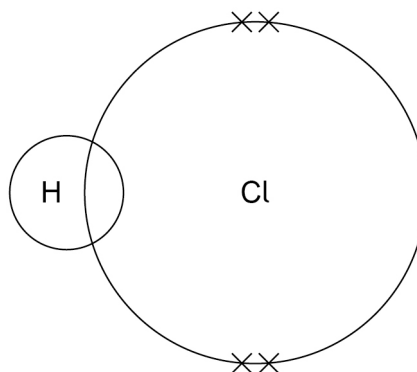
Complete the dot and cross diagram.

Use dots (o) and crosses (x) to represent electrons.

You should show only the electrons in the outer shells.

[2 marks]

Figure 4



0 2 . 2

Hydrogen chloride dissolves in water to produce hydrochloric acid.

Hydrochloric acid reacts with sodium hydroxide solution.

Complete the word equation for the reaction between hydrochloric acid and sodium hydroxide.

[1 mark]

hydrochloric acid + sodium hydroxide → _____ + water

Question 2 continues on the next page

Turn over ►



Solutions of hydrochloric acid and sodium hydroxide are reacted and the temperature change is recorded.

0 2 . 3 In the reaction, 3.65 g of hydrogen chloride reacts with 4.00 g of sodium hydroxide.

1.80 g of water is produced.

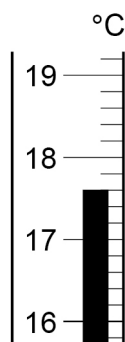
Calculate the mass of the other product.

[1 mark]

Mass = _____ g

0 2 . 4 **Figure 5** shows part of the thermometer used to measure the temperature.

Figure 5



What is the temperature reading on the thermometer?

[1 mark]

Temperature = _____ °C

0 2 . 5 In the reaction, the temperature increases.

What type of reaction is happening when the temperature increases?

[1 mark]

0 2 . 6 Sodium hydroxide is an alkali.

Which **two** ions are in sodium hydroxide solution?

[2 marks]

Tick (✓) **two** boxes.

Cl⁻ ☐ H⁺ ☐ Na⁺ ☐ O²⁻ ☐ OH⁻ ☐

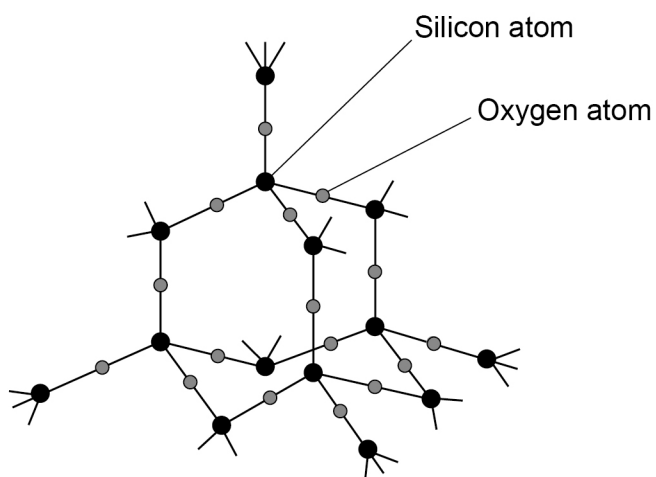


0 3

This question is about structure and bonding.

Figure 6 represents part of the structure of silicon dioxide.

Figure 6



0 3 . 1

What type of structure is silicon dioxide?

[1 mark]

Tick (✓) **one** box.

Giant covalent

☐

Ionic lattice

☐

Simple molecular

☐

0 3 . 2

Each oxygen atom forms two bonds.

What is the number of bonds formed by each silicon atom?

Use **Figure 6**.

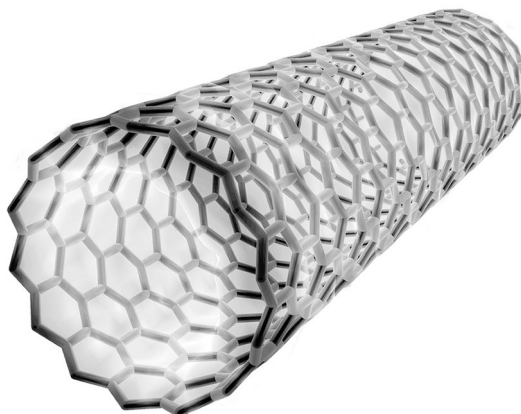
[1 mark]

Turn over ►



Figure 7 represents part of a fullerene.

Figure 7



0 3 . 3

Complete the sentence.

Choose the answer from the box.

[1 mark]

hexagons

octagons

squares

triangles

The structure of fullerenes is based on _____.

0 3 . 4

Complete the sentence.

Choose the answer from the box.

[1 mark]

carbon

hydrogen

oxygen

The fullerene molecule shown in **Figure 7** is made from
atoms of _____.



0 3 . 5

What is the fullerene molecule shown in **Figure 7** used for?**[1 mark]**Tick (✓) **one** box.

Electronics

☐

Hand warmers

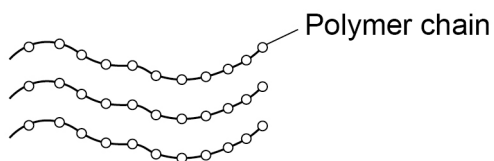
☐

Sports injury packs

☐**Question 3 continues on the next page****Turn over ►**

Figure 8 represents part of the structure of a polymer.

Figure 8



0 3 . 6

What holds the atoms together in a polymer chain?

[1 mark]

Tick (✓) **one** box.

Covalent bonds

☐

Ionic bonds

☐

Metallic bonds

☐

0 3 . 7

Complete the sentence.

Choose the answer from the box.

[1 mark]

atomic intermolecular macromolecular

In **Figure 8** the polymer chains are held together by

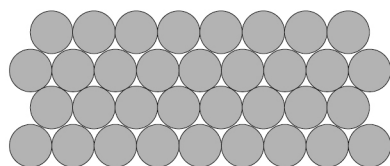
_____ forces.



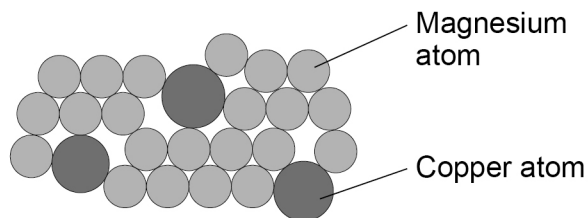
Figure 9 represents part of the structures of:

- magnesium metal
- a magnesium alloy.

Figure 9



Magnesium metal



Magnesium alloy

0 3 . 8

Calculate the percentage of copper atoms in the alloy.

[3 marks]

Number of magnesium atoms in the alloy = _____

Number of copper atoms in the alloy = _____

Total number of atoms in the alloy = _____

Percentage of copper atoms in the alloy = _____ %

0 3 . 9

Explain why the magnesium alloy is harder than magnesium metal.

Use **Figure 9**.

[3 marks]



There are no questions printed on this page

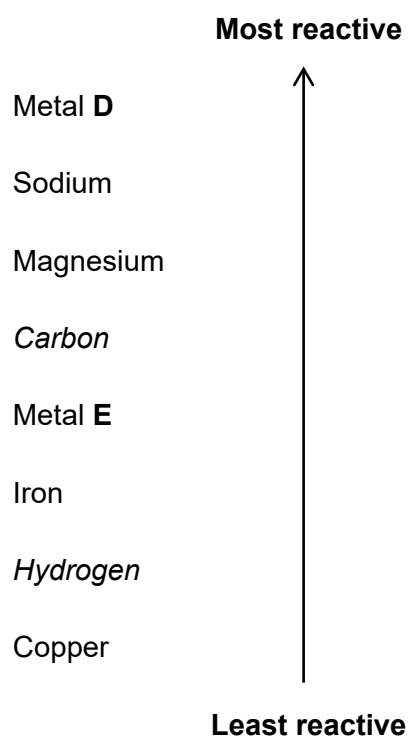
*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



0 4 . 5 Figure 10 shows a reactivity series.

Figure 10



Draw **one** line from each metal to the method used to extract that metal.

Use **Figure 10**.

[2 marks]

Metal

Method used to extract that metal

Metal **D**

Extracted by electrolysis of a molten ionic compound.

Extracted from its oxide by reduction with carbon.

Extracted from its oxide by reduction with hydrogen.

Metal **E**

Removed from the Earth as the metal itself.

Question 4 continues on the next page

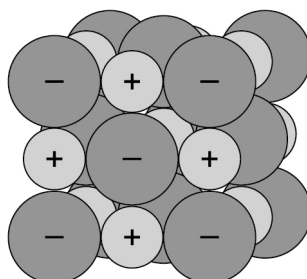
Turn over ►



A substance conducts electricity when it has charged particles that are free to move.

0 4 . 6 **Figure 11** represents the structure of sodium chloride.

Figure 11



Sodium chloride

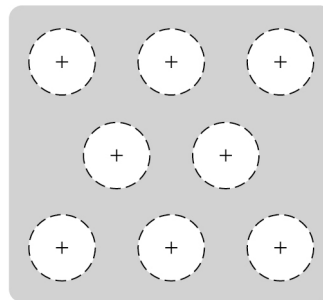
Explain why sodium chloride conducts electricity when molten but **not** when solid.

[3 marks]



0 4 . 7 **Figure 12** represents the structure of sodium metal.

Figure 12



Sodium metal

Explain why sodium metal conducts electricity when solid.

[2 marks]

13

Turn over for the next question

Turn over ►



There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



0 5

This question is about salts.

Green copper carbonate and sulfuric acid can be used to produce blue copper sulfate crystals.

0 5 . 1**Excess** copper carbonate is added to sulfuric acid.Give **three** observations you would make.**[3 marks]**

1 _____

2 _____

3 _____

0 5 . 2

How can the excess copper carbonate be removed?

[1 mark]

0 5 . 3

The pH of the solution changes during the reaction.

What is the pH of the solution at the end of the reaction?

[1 mark]

pH = _____

0 5 . 4

Copper carbonate and sulfuric acid react to produce copper sulfate.

What type of reaction is this?

[1 mark]

Turn over ►

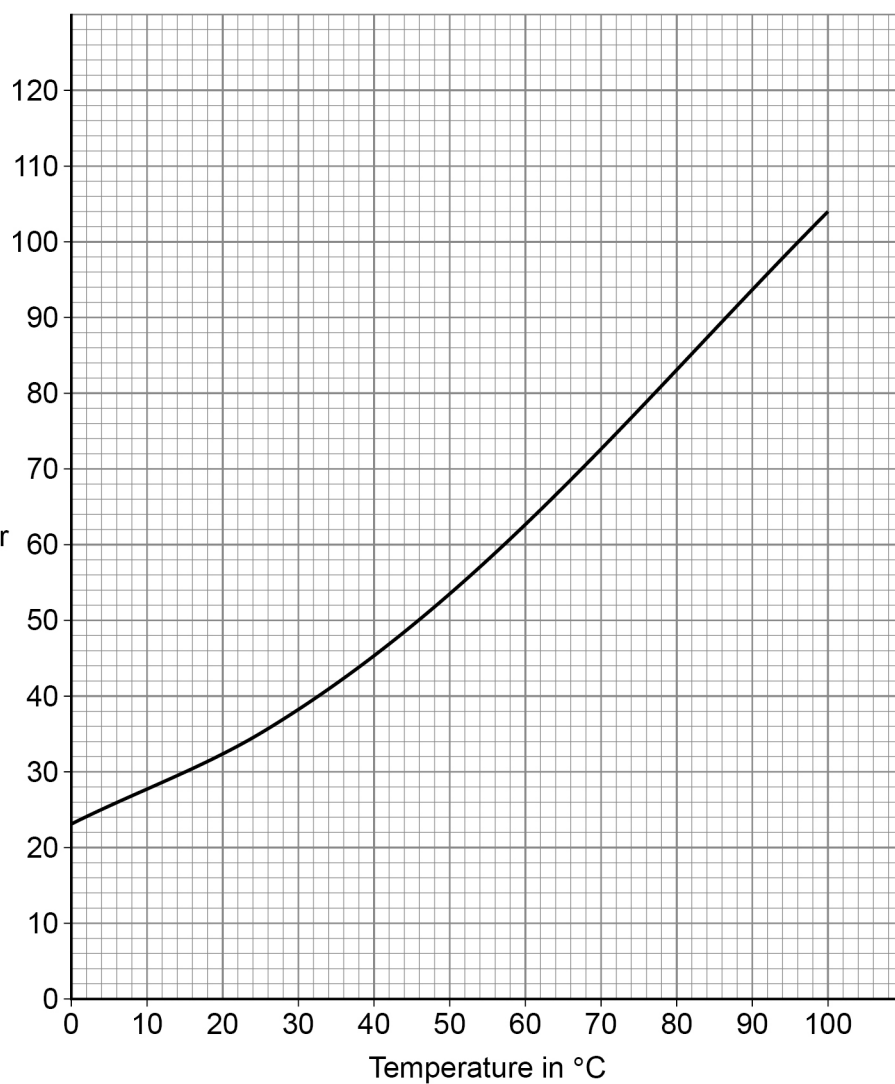
0 5 . 5

Ammonium nitrate is a salt.

Figure 13 shows the maximum mass of ammonium nitrate that can dissolve in 100 cm³ of water at different temperatures.

Figure 13

Maximum mass
of ammonium
nitrate that can
dissolve in grams per
100 cm³ of water



A student adds ammonium nitrate to water at 80 °C until no more dissolves.

The student cools 100 cm³ of this solution of ammonium nitrate from 80 °C to 20 °C to produce crystals of ammonium nitrate.

Determine the mass of ammonium nitrate that crystallises on cooling 100 cm³ of this solution from 80 °C to 20 °C

[3 marks]

Mass = _____ g

9

Turn over for the next question

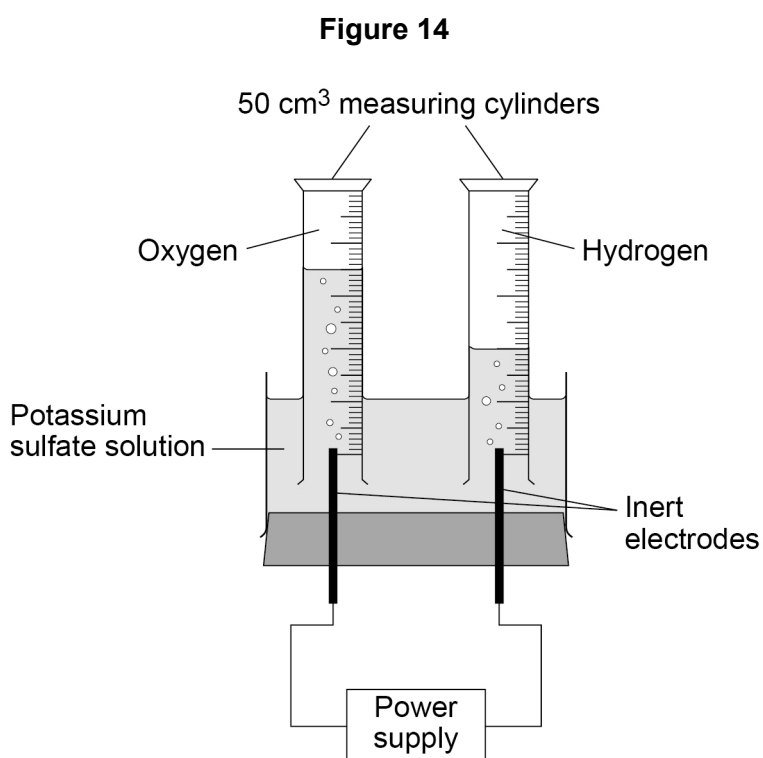
Turn over ►



0 6

This question is about electrolysis.

Figure 14 shows the apparatus used to investigate the electrolysis of potassium sulfate solution.



0 6

1

Potassium sulfate contains K^+ and SO_4^{2-} ions.

What is the formula of potassium sulfate?

[1 mark]

Tick (✓) **one** box.

KSO_4

☐

K_2SO_4

☐

$K(SO_4)_2$

☐

$K_2(SO_4)_2$

☐


06.2

What are the volumes of gases collected in the electrolysis experiment?

Use **Figure 14**.

[1 mark]

Volume of hydrogen = _____ cm³

Volume of oxygen = _____ cm³

06.3

A student made the following hypothesis:

‘The volumes of gases collected in this electrolysis experiment are in the same ratio as hydrogen atoms to oxygen atoms in a water molecule.’

Explain how the volumes of gases collected in the experiment in **Figure 14** support the student’s hypothesis.

Use your answer to Question **06.2**

[2 marks]

Question 6 continues on the next page

Turn over ►



0 6 . 4

The experiment is repeated 4 times.

The volumes of oxygen collected in the 4 experiments are:

6 cm³ 9 cm³ 10 cm³ 11 cm³

The mean volume of oxygen collected in the 4 experiments is 9 cm³

The measure of uncertainty is the range of a set of measurements about the mean.

What is the measure of uncertainty in the 4 experiments?

[1 mark]

Tick (✓) **one** box.

9 ± 1 cm³

☐

9 ± 2 cm³

☐

9 ± 3 cm³

☐

0 6 . 5

The potassium sulfate solution has 0.86 g of potassium sulfate dissolved in 25 cm³ of water.

Calculate the mass of potassium sulfate needed to make 1.0 dm³ of solution.

[3 marks]

Mass = _____ g

8



You should use the temperature change when each metal reacts with hydrochloric acid.

[illegible]

6

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**



*Do not write
outside the
box*

[illegible]

[illegible]

Do not write
outside the
box

[illegible]

There are no questions printed on this page

*Do not write
outside the
box*

**DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED**

Copyright information

For confidentiality purposes, all acknowledgements of third-party copyright material are published in a separate booklet. This booklet is published after each live examination series and is available for free download from www.aqa.org.uk.

Permission to reproduce all copyright material has been applied for. In some cases, efforts to contact copyright-holders may have been unsuccessful and AQA will be happy to rectify any omissions of acknowledgements. If you have any queries please contact the Copyright Team.

Copyright © 2022 AQA and its licensors. All rights reserved.



3 2



2 2 6 G 8 4 6 4 / C / 1 F

IB/M/Jun22/8464/C/1F