AQA

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.

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

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.

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.

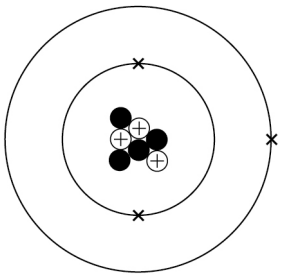
Alkali metals ☐

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 _____

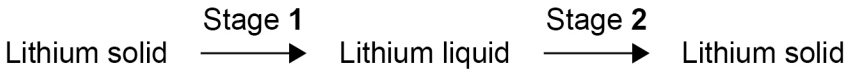
0 1 . 3 What is the relative charge on a lithium ion?

[1 mark]

Tick (✓) **one** box.

+1 ☐ 0 ☐ –1 ☐

0 1 . 4 Lithium is heated and then cooled in an experiment.



Two physical changes happen in the experiment.

Draw **one** line from each stage to the physical change that happens in that stage.

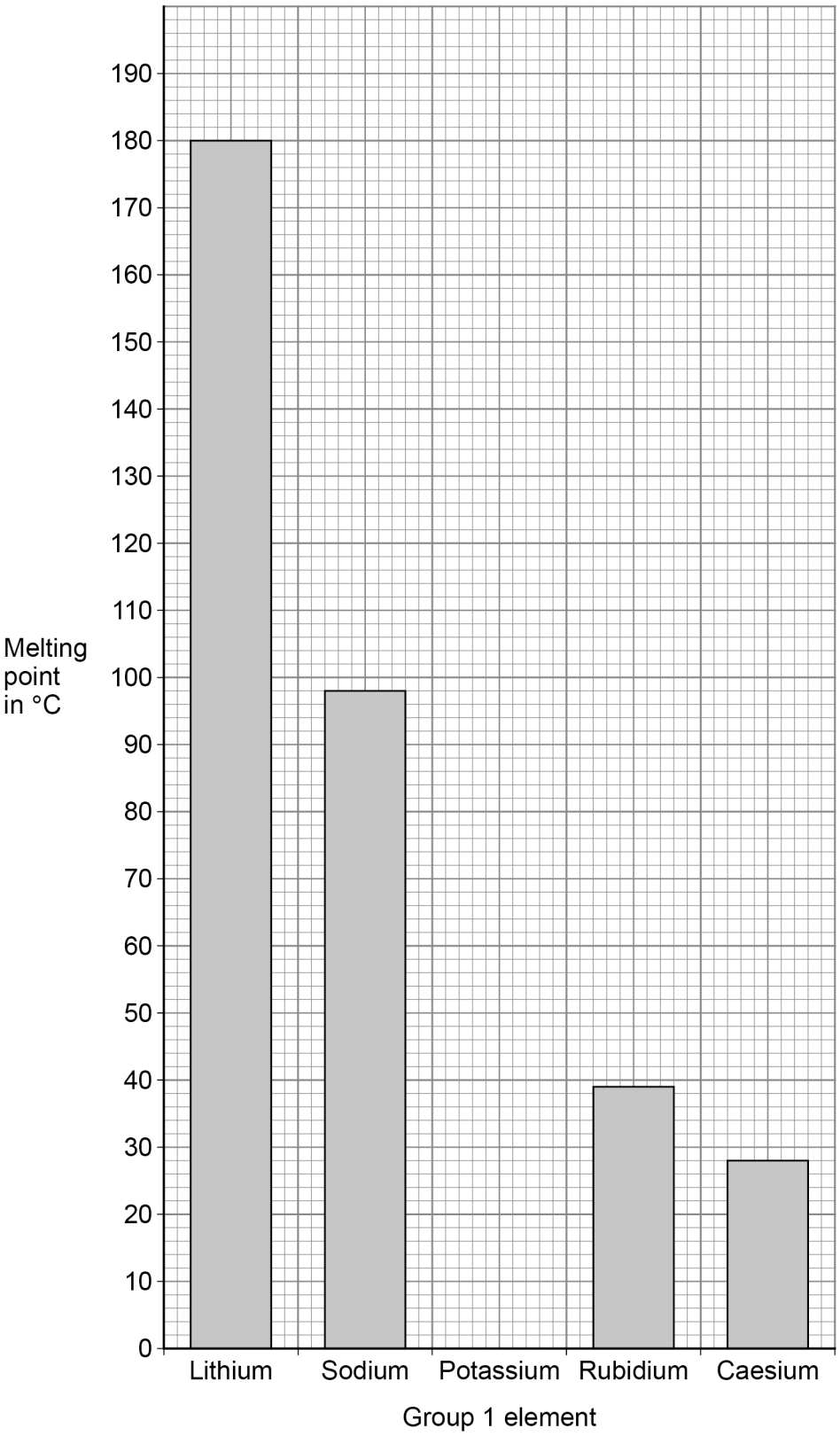
[2 marks]

Stage	**Physical change**
	Boiling
	Condensing
Stage **1**	
	Dissolving
Stage **2**	
	Freezing
	Melting

Question 1 continues on the next page

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.

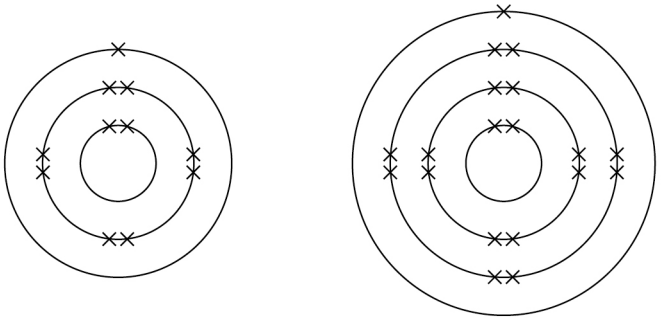
Gas ☐

Liquid ☐

Solid ☐

0 1 . 9 **Figure 3** represents the electronic structure of a sodium atom and of a potassium atom.

Figure 3



Sodium atom Potassium atom

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.

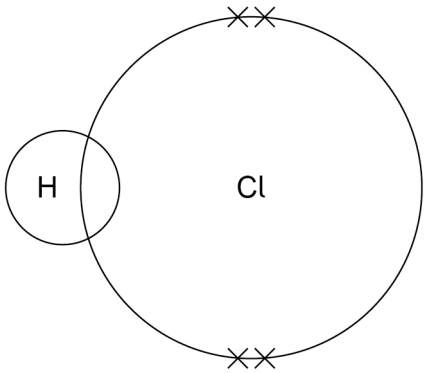
Complete the dot and cross diagram.

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

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.

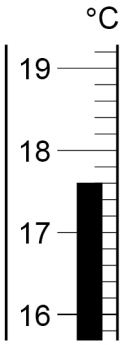
Calculate the mass of the other product.

[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.

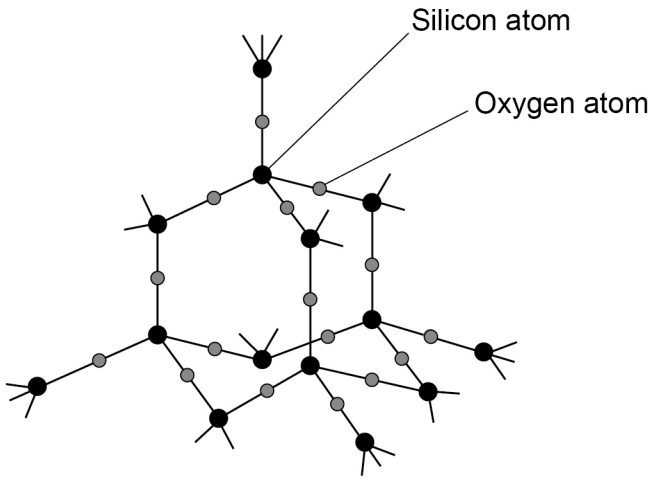
Cl^- ☐ H^+ ☐ Na^+ ☐ O^{2-} ☐ OH^- ☐

8

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?

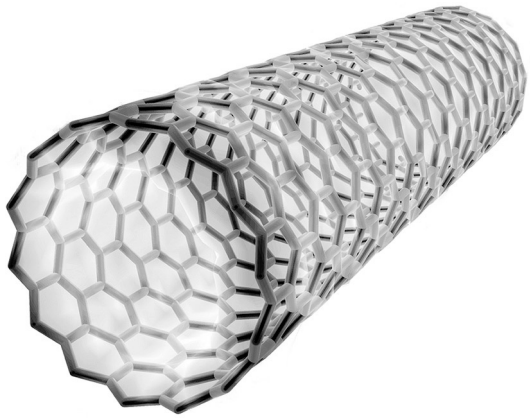
Use **Figure 6**.

[1 mark]

_____

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 ☐

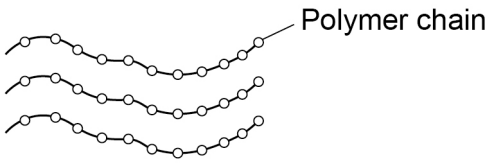
Hand warmers ☐

Sports injury packs ☐

Question 3 continues on the next page

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**

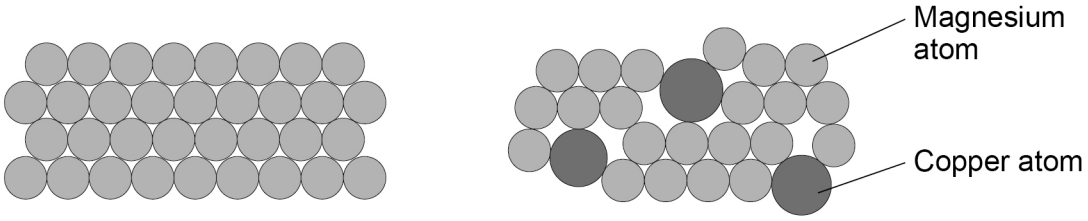
In **Figure 8** the polymer chains are held together by

_____ 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]

_____

_____

_____

_____

_____

_____

13

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0 4 This question is about elements and compounds.

0 4 . 1 Magnesium and oxygen react to produce magnesium oxide.

Balance the equation for the reaction.

[1 mark]

$$\_\_\_\_\_ Mg + O_2 \rightarrow 2\,MgO$$

0 4 . 2 Suggest **one** safety precaution that should be taken when heating magnesium and oxygen.

[1 mark]

0 4 . 3 Calculate the relative formula mass (M_r) of magnesium fluoride (MgF_2).

Relative atomic masses (A_r): F = 19 Mg = 24

[2 marks]

Relative formula mass (M_r) = _____

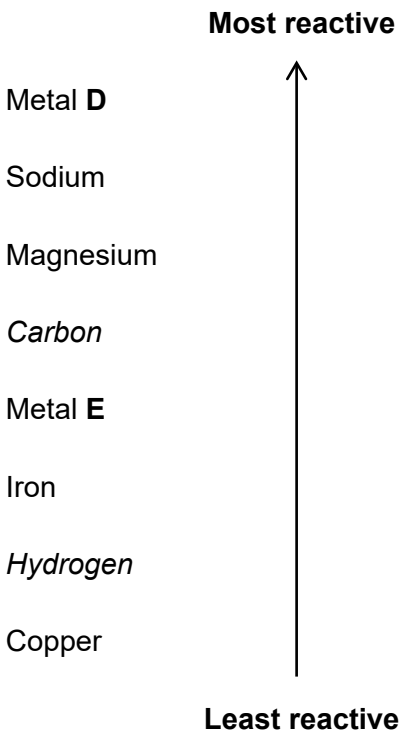
0 4 . 4 Argon is a noble gas.

Explain why **no** product is formed when magnesium and argon are heated together.

[2 marks]

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]

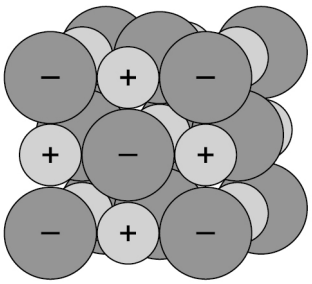
Metal	**Method used to extract that metal**
	Extracted by electrolysis of a molten ionic compound.
Metal **D**	Extracted from its oxide by reduction with carbon.
	Extracted from its oxide by reduction with hydrogen.
Metal **E**	
	Removed from the Earth as the metal itself.

Question 4 continues on the next page

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



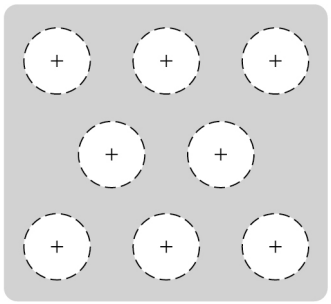
Sodium chloride

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

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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?

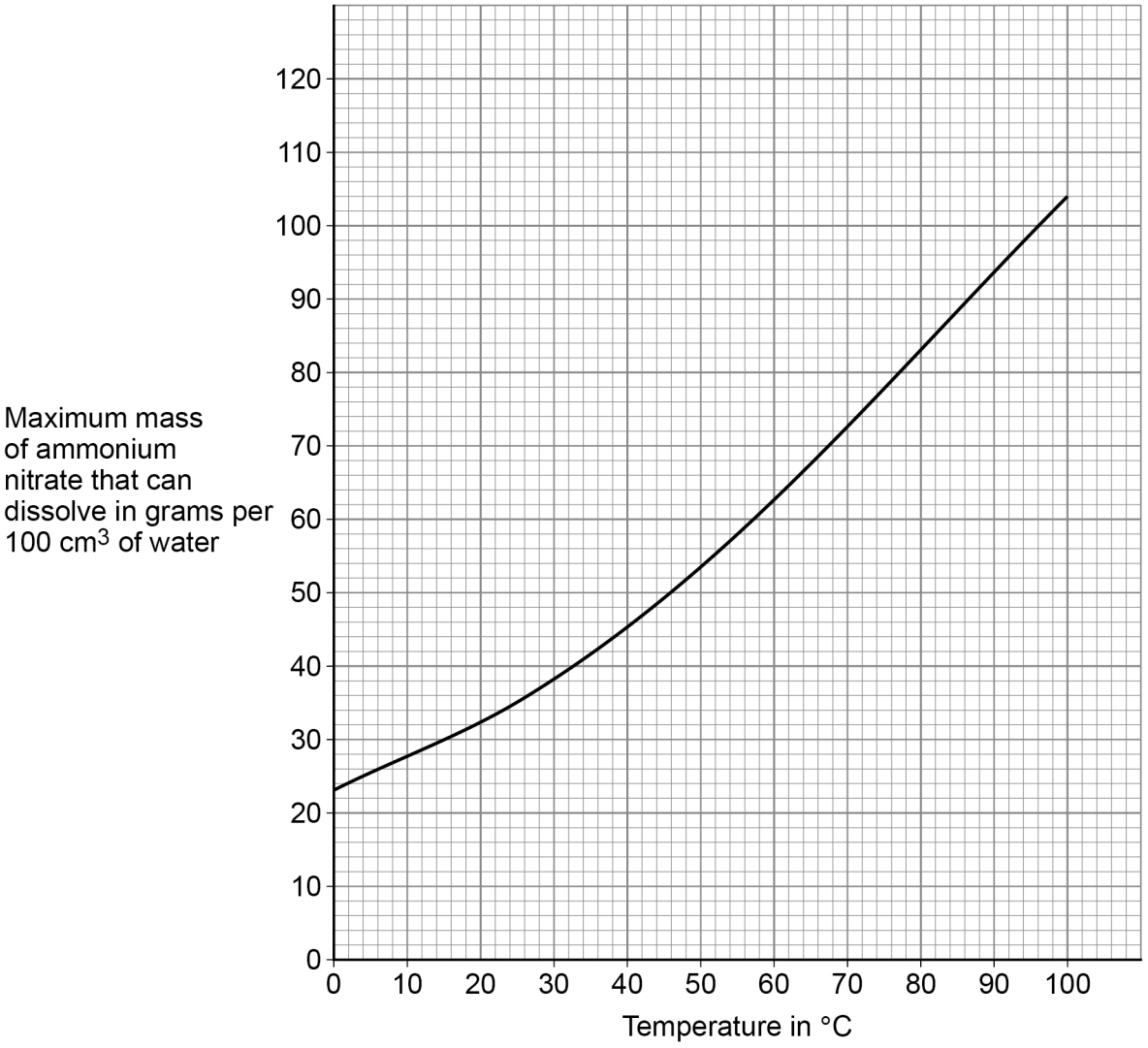
[1 mark]

_____

0 5 . 5 Ammonium nitrate is a salt.

Figure 13 shows the maximum mass of ammonium nitrate that can dissolve in 100 cm^3 of water at different temperatures.

Figure 13



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

The student cools 100 cm^3 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 cm^3 of this solution from 80 °C to 20 °C

[3 marks]

Mass = _____ g

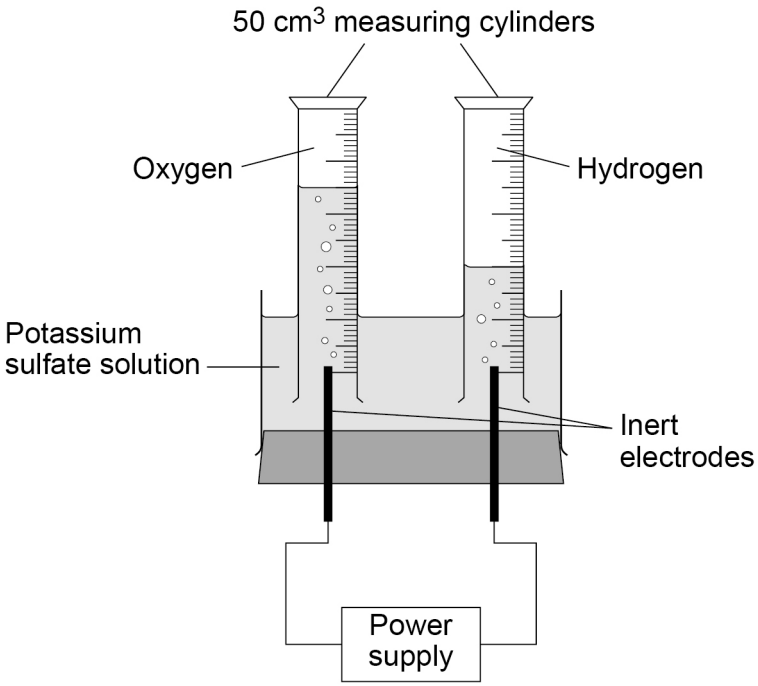
9

Turn over for the next question

0 6 This question is about electrolysis.

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

Figure 14



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 ☐

$K(SO_4)_2$ ☐

$K_2(SO_4)_2$ ☐

0 6 . 2 What are the volumes of gases collected in the electrolysis experiment?

Use **Figure 14**.

[1 mark]

Volume of hydrogen = _____ cm^3

Volume of oxygen = _____ cm^3

0 6 . 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

0 6 . 4 The experiment is repeated 4 times.

The volumes of oxygen collected in the 4 experiments are:

6 cm^3 9 cm^3 10 cm^3 11 cm^3

The mean volume of oxygen collected in the 4 experiments is 9 cm^3

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 cm^3 ☐

9 ± 2 cm^3 ☐

9 ± 3 cm^3 ☐

0 6 . 5 The potassium sulfate solution has 0.86 g of potassium sulfate dissolved in 25 cm^3 of water.

Calculate the mass of potassium sulfate needed to make 1.0 dm^3 of solution.

[3 marks]

Mass = _____ g

8

0 7 Plan an investigation to find the order of reactivity of three metals.

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

[6 marks]

END OF QUESTIONS

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