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	

Do not write outside the box

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.

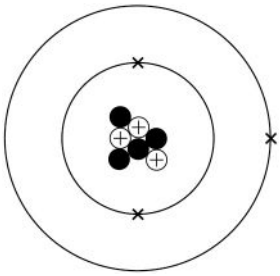
Alkali metals ☐

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 ☐

Do not write outside the box

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.

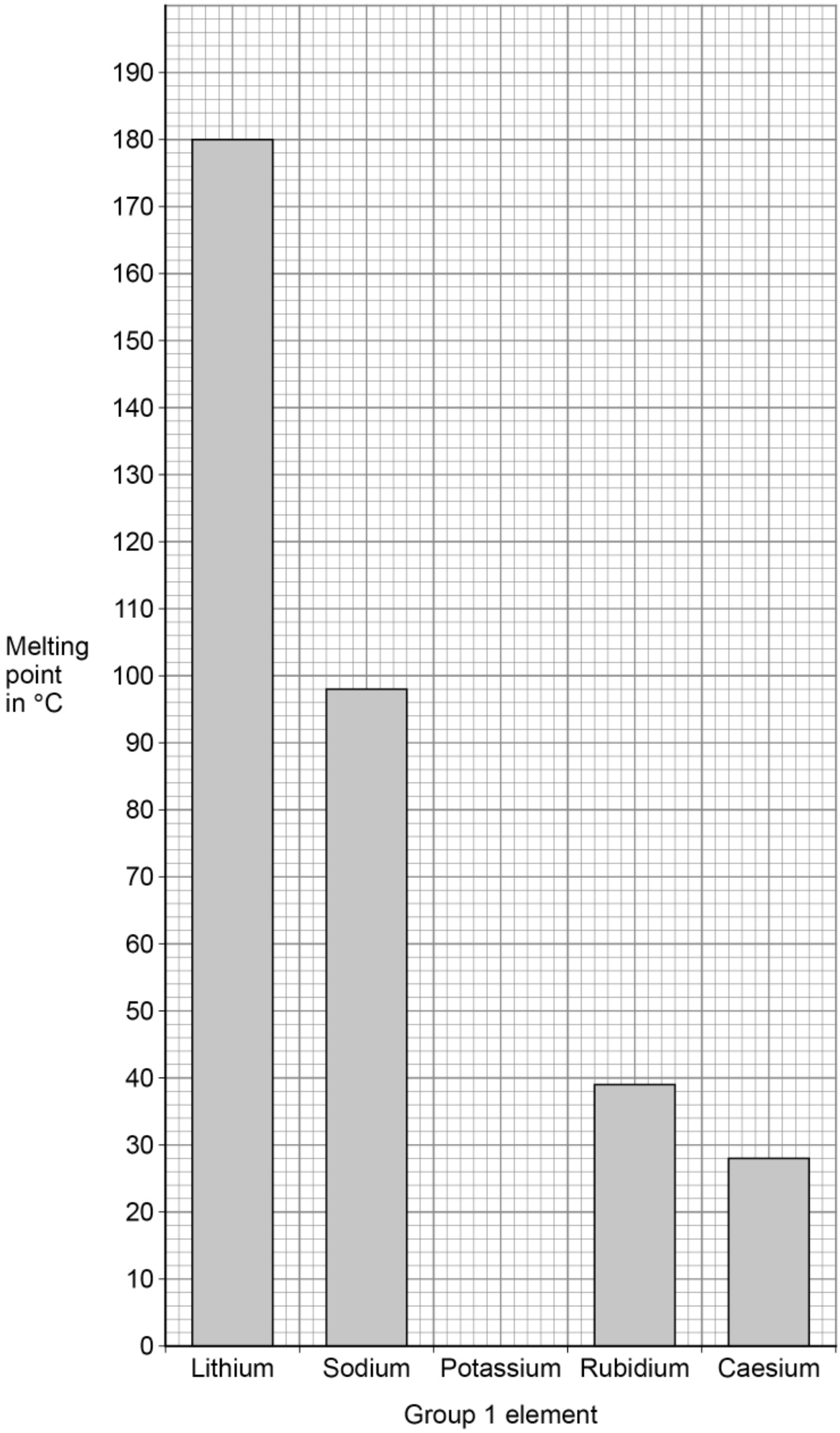
[2 marks]

Stage	**Physical change**
	Boiling
Stage **1**	Condensing
	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



Do not write outside the box

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 ☐

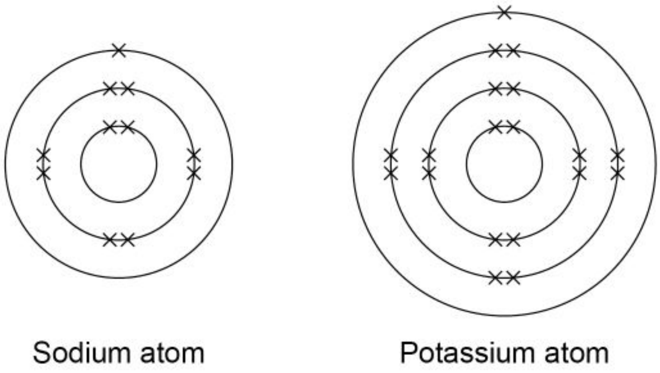
Solid ☐

Turn over ►

Do not write outside the box

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.

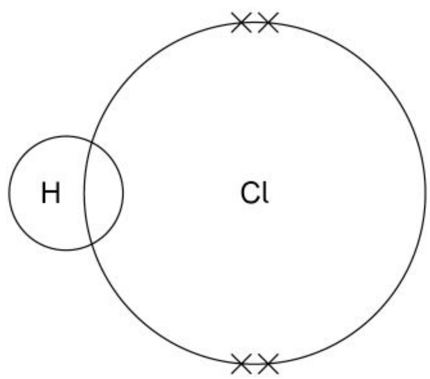
Complete the dot and cross diagram.

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

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.

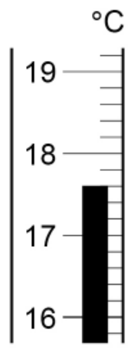
[1 mark]

____

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.

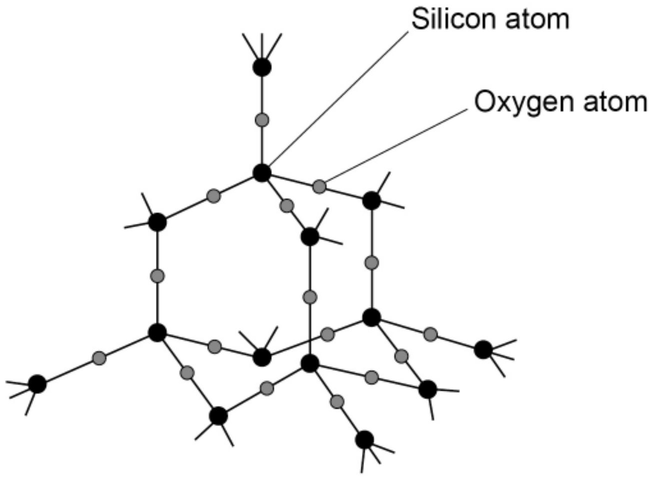
Cl^- ☐ H^+ ☐ Na^+ ☐ O^{2-} ☐ OH^- ☐

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**.

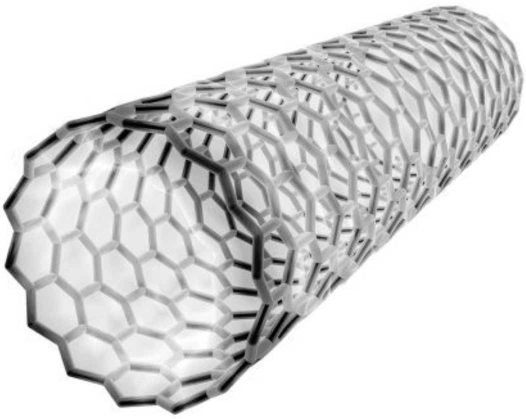
[1 mark]

____

Do not write outside the box

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 ______________________________ .

Do not write outside the box

0 3 . 5 What is the fullerene molecule shown in **Figure 7** used for?

[1 mark]

Tick (✓) **one** box.

Electronics ☐

Hand warmers ☐

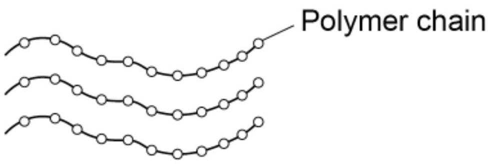
Sports injury packs ☐

Question 3 continues on the next page

Do not write outside the box

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

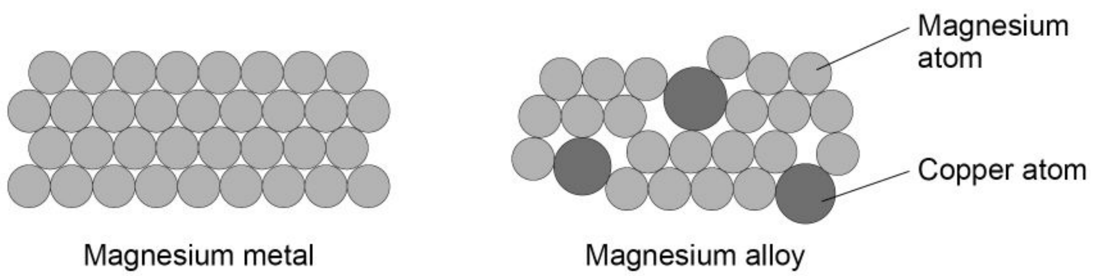
____________________________________ forces.

Do not write outside the box

Figure 9 represents part of the structures of:

- magnesium metal
- a magnesium alloy.

Figure 9



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

Turn over ►

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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]

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

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]

____

____

____

____

Turn over ►

0 4 . 5 **Figure 10** shows a reactivity series.

Figure 10

Most reactive

Metal **D**

Sodium

Magnesium

Carbon

Metal **E**

Iron

Hydrogen

Copper

Least reactive

Do not write outside the box

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.

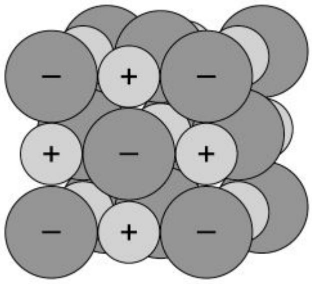
Question 4 continues on the next page

Do not write outside the box

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

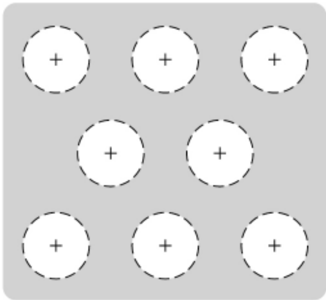
Explain why sodium chloride conducts electricity when molten but **not** when solid.

[3 marks]

Do not write outside the box

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

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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]

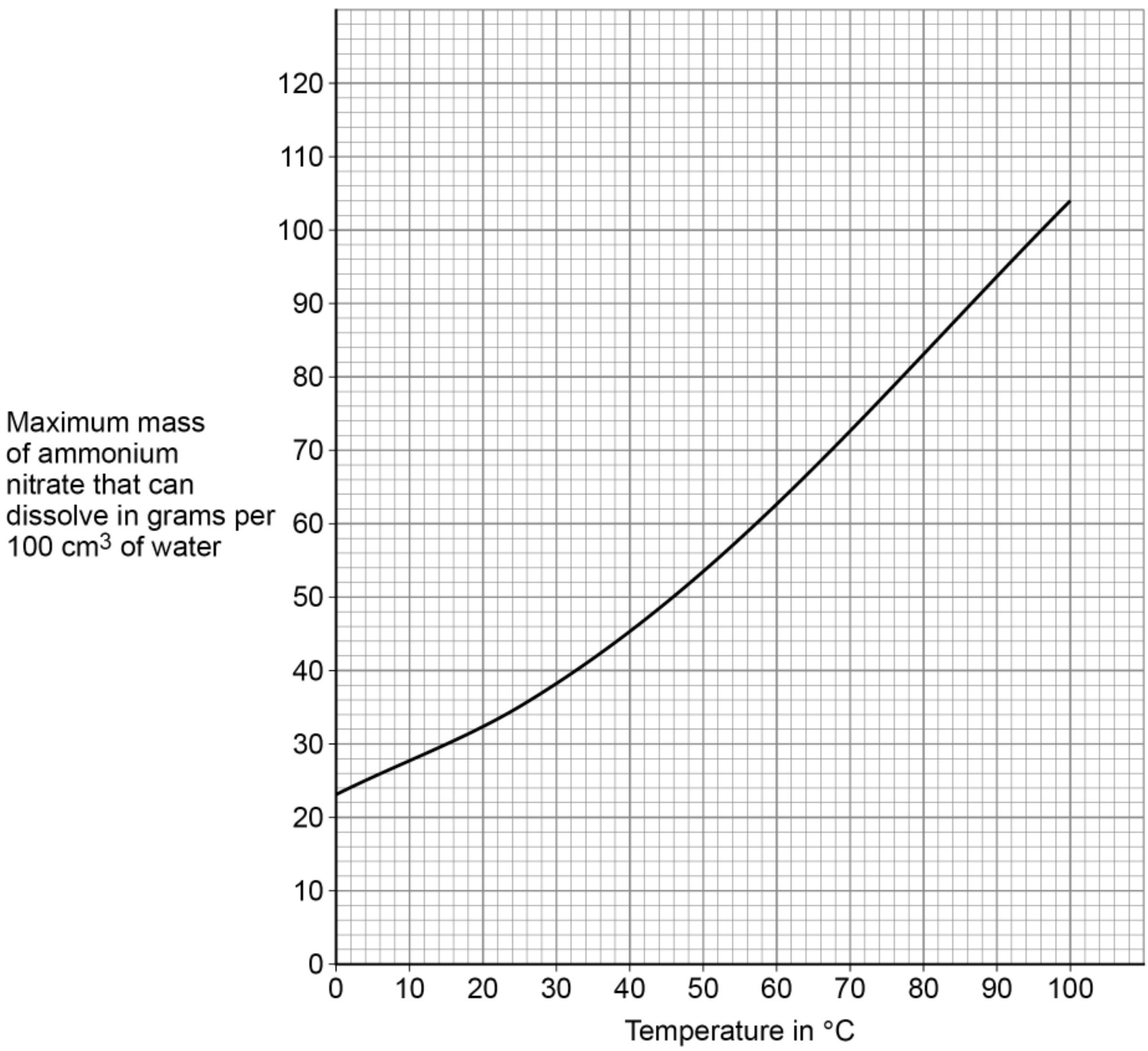
____

Turn over ►

0 5 . 5 Ammonium nitrate is a salt.

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

Figure 13



Do not write outside the box

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

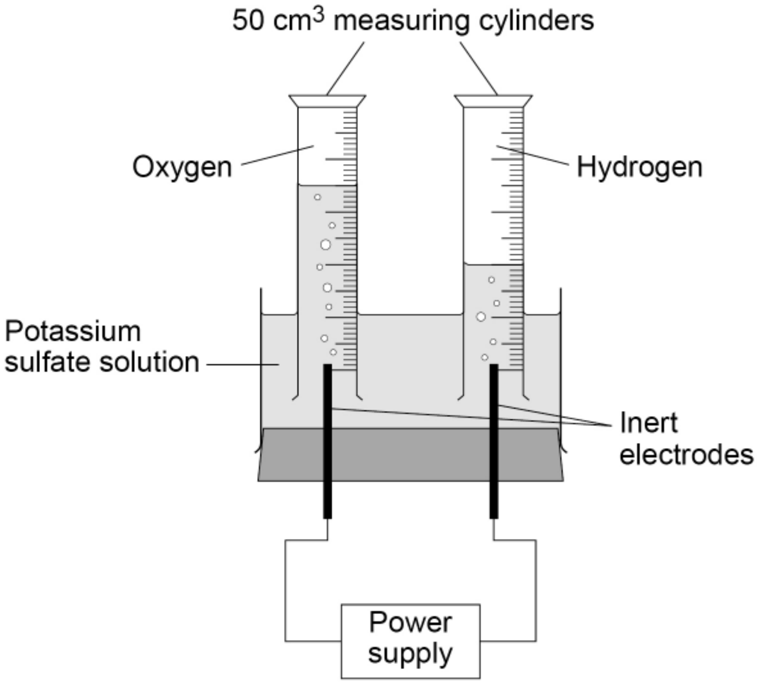
9

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 ☐

$K(SO_4)_2$ ☐

$K_2(SO_4)_2$ ☐

Do not write outside the box

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

Do not write outside the box

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

Do not write outside the box

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]

6

END OF QUESTIONS

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**

Do not write outside the box

Question number	**Additional page, if required. Write the question numbers in the left-hand margin.**

Do not write outside the box

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED