A

AQA

Surname _____

Other Names _____

Centre Number _____

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I declare this is my own work.

GCSE

COMBINED SCIENCE: TRILOGY

F

Foundation Tier
Chemistry Paper 1F

8464/C/1F

Thursday 14 May 2020   Morning

Time allowed: 1 hour 15 minutes

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

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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.**

- **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.**

DO NOT TURN OVER UNTIL TOLD TO DO SO

0 1 This question is about acids and bases.

0 1 . **1** What is the pH of sulfuric acid? [1 mark]

Tick (✓) ONE box.

☐ 1

☐ 7

☐ 14

0 1 . **2** An acid reacts with zinc to produce zinc chloride and hydrogen.

Which acid reacts with zinc to produce zinc chloride? [1 mark]

Tick (✓) ONE box.

☐ **Hydrochloric acid**

☐ **Nitric acid**

☐ **Sulfuric acid**

0 1 . 3 **What type of substance is zinc chloride?**
[1 mark]

Tick (✓) ONE box.

	Alkali
	Base
	Salt

0 1 . 4 **An alkali is a base in solution.**

Which compound is an alkali? [1 mark]

Tick (✓) ONE box.

	Sodium hydroxide
	Sodium nitrate
	Sodium sulfate

[Turn over]

0 5

0 1 . 5 The formula of the copper ion is Cu^{2+}

The formula of the oxide ion is O^{2-}

What is the formula of copper oxide?
[1 mark]

Tick (✓) ONE box.

☐ Cu_2O_2

☐ CuO_2

☐ CuO

A student reacts an acid with copper oxide.

0 1 . 6 The reaction between the acid and copper oxide is very slow at room temperature.

How could the student speed up the reaction?
[1 mark]

_____

_____

_____

0 1 . 7 **Complete the sentence to show how the student makes sure that ALL the acid reacts.**

Choose the answer from the list. [1 mark]

- **in excess**
- **in solution**
- **molten**
- **soluble**

The student adds copper oxide to the
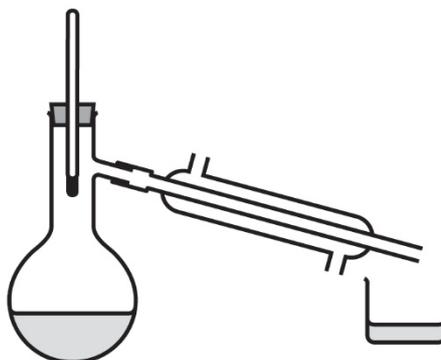
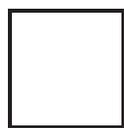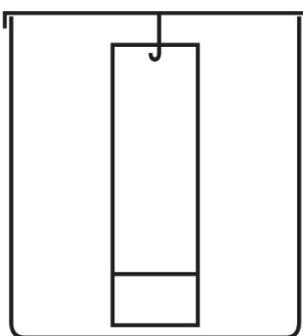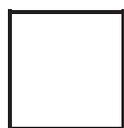**acid until the copper oxide is**

_____ .
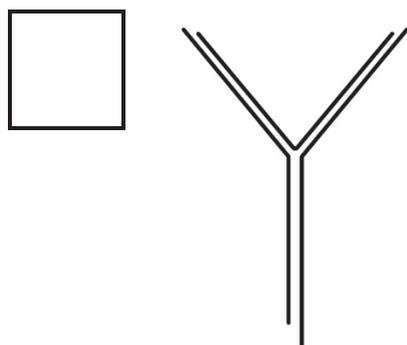
[Turn over]

0 7

0 1 . 8 **The student filters the unreacted copper oxide from the solution.**

Which apparatus does the student use?
[1 mark]

Tick (✓) ONE box.

☐ Y

☐ ⌣

| 0 | 1 |. | 9 | **What process is used to produce crystals of a salt from a salt solution? [1 mark]**
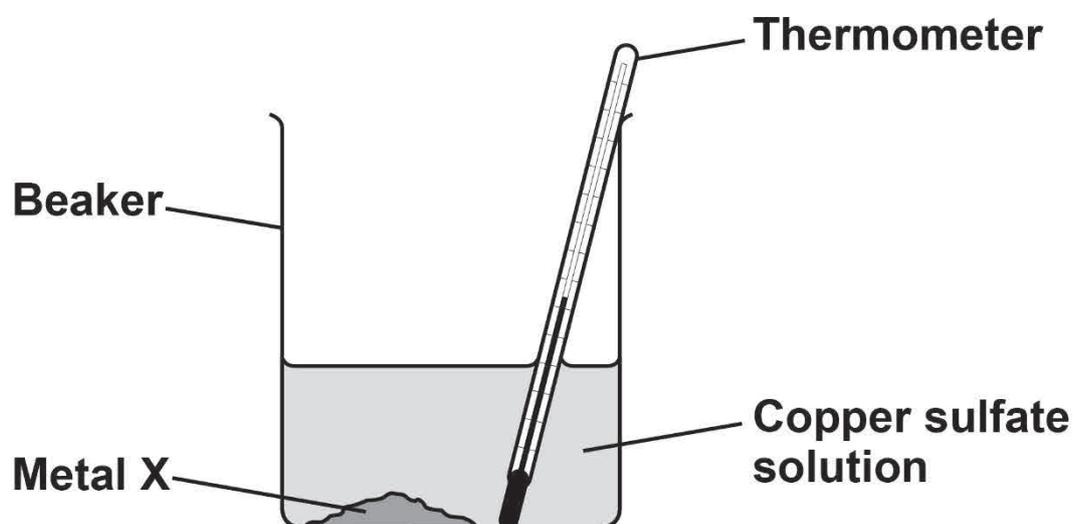
_____

_____

_____

[Turn over]

9

0 2 A student investigated the temperature change when metal X was added to copper sulfate solution.

This is the method used.

1. Add 25 cm^3 of copper sulfate solution to a beaker.

2. Measure the temperature of the copper sulfate solution.

3. Add 1.0 g of metal X and stir.

4. Measure the highest temperature reached when metal X is added to copper sulfate solution.

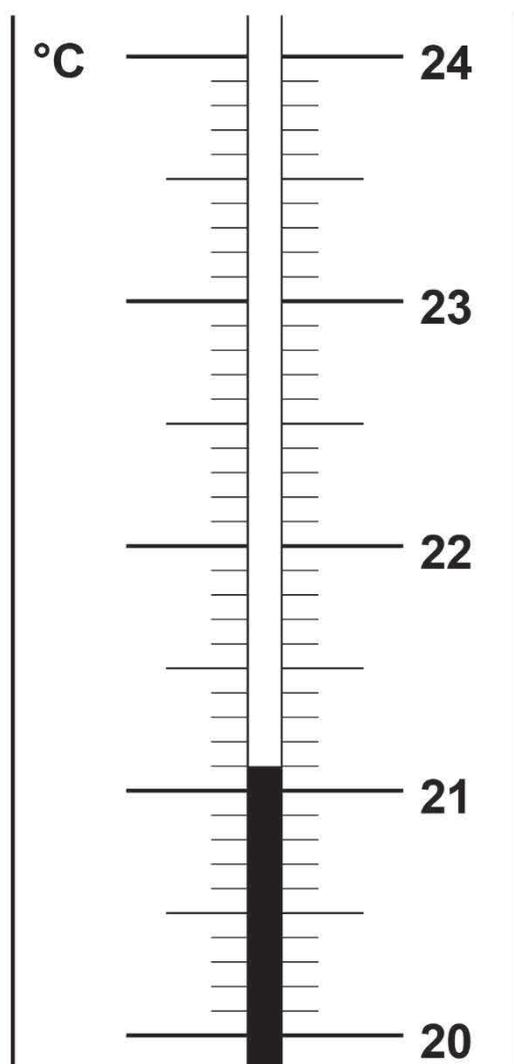5. Repeat steps 1 to 4 with different metals.

FIGURE 1 shows the apparatus used.

FIGURE 1

FIGURE 2 shows the thermometer reading of the copper sulfate solution at the start of the investigation.

FIGURE 2

BLANK PAGE

0 2 . 1 **The highest temperature reached when metal X was added to copper sulfate solution was 35.5 °C**

Determine the temperature change when metal X is added to copper sulfate solution.

Use FIGURE 2 on page 11. [2 marks]

Highest temperature =   35.5   °C

Temperature at start = _____ °C

Temperature change = _____ °C

0 2 . 2 **Give TWO variables the student should keep the same in this investigation. [2 marks]**

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

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0 2 . 3 **The student repeated the experiment with metal Y.**

TABLE 1 shows four results for metal Y.

TABLE 1

	Test 1	Test 2	Test 3	Test 4
Temperature change in °C	9.2	7.3	9.5	9.2

Calculate the mean temperature change for metal Y.

Do NOT include the anomalous result in your calculation. [2 marks]

_____

_____

_____

_____

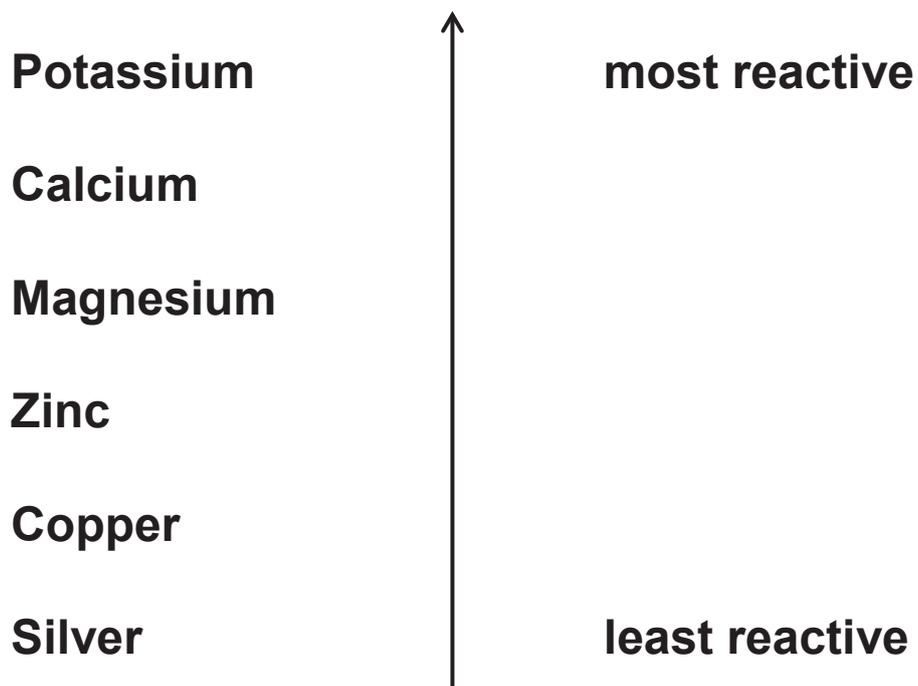_____

Mean temperature change = _____ °C

[Turn over]

1 5

The more reactive the metal added to copper sulfate solution, the greater the temperature change.

FIGURE 3 shows a reactivity series.

FIGURE 3

Potassium	most reactive
Calcium	
Magnesium	
Zinc	
Copper	
Silver	least reactive

0 2 . 4 **The student repeated the experiment.**

The student added:

- **magnesium to copper sulfate solution**
- **an unknown metal A to copper sulfate solution.**

TABLE 2 shows the results.

TABLE 2

Metal	Temperature change in °C
Magnesium	12
Metal A	8

The student concludes metal A is zinc.

Give ONE reason why the student is correct.

Use FIGURE 3 and TABLE 2. [1 mark]
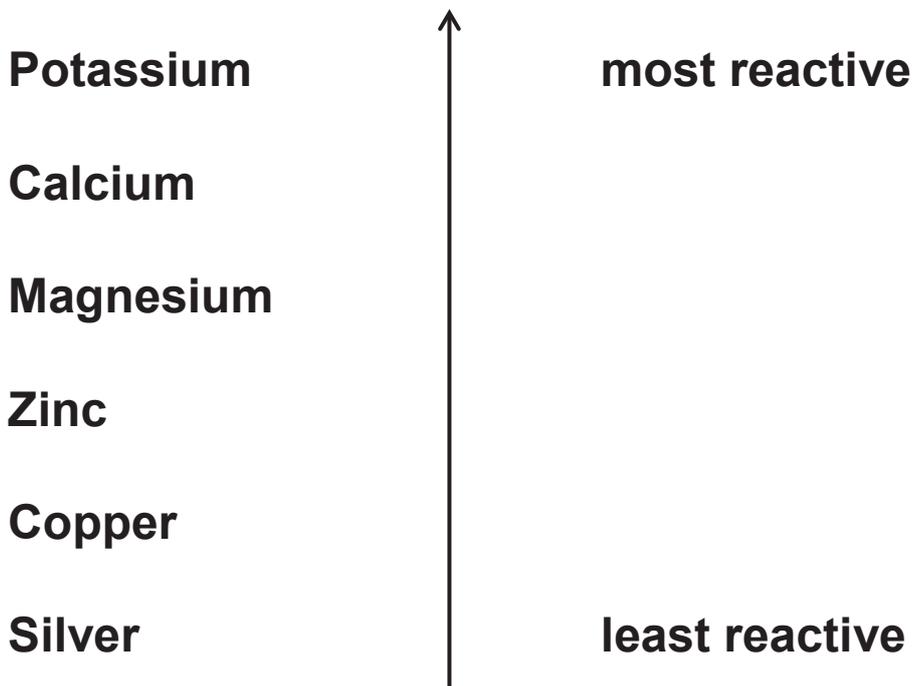
_____

_____

_____

[Turn over]

REPEAT OF FIGURE 3

Potassium   most reactive

Calcium

Magnesium

Zinc

Copper

Silver   least reactive

| 0 | 2 |.| 5 | **The student did the experiment with silver and copper sulfate solution.**

What happens to the temperature of the mixture? [1 mark]

Use FIGURE 3.

Tick (✓) ONE box.

☐ **Decreases**

☐ **Increases**

☐ **Stays the same**

0 2 . 6 Suggest ONE reason why the student should NOT add potassium metal to copper sulfate solution. **[1 mark]**

_____

_____

_____

0 2 . 7 100 cm^3 of the copper sulfate solution contains 1.8 g of copper sulfate.

Calculate the mass of copper sulfate in 25 cm^3 of this copper sulfate solution. **[2 marks]**

_____

_____

_____

_____

_____

Mass = _____ g

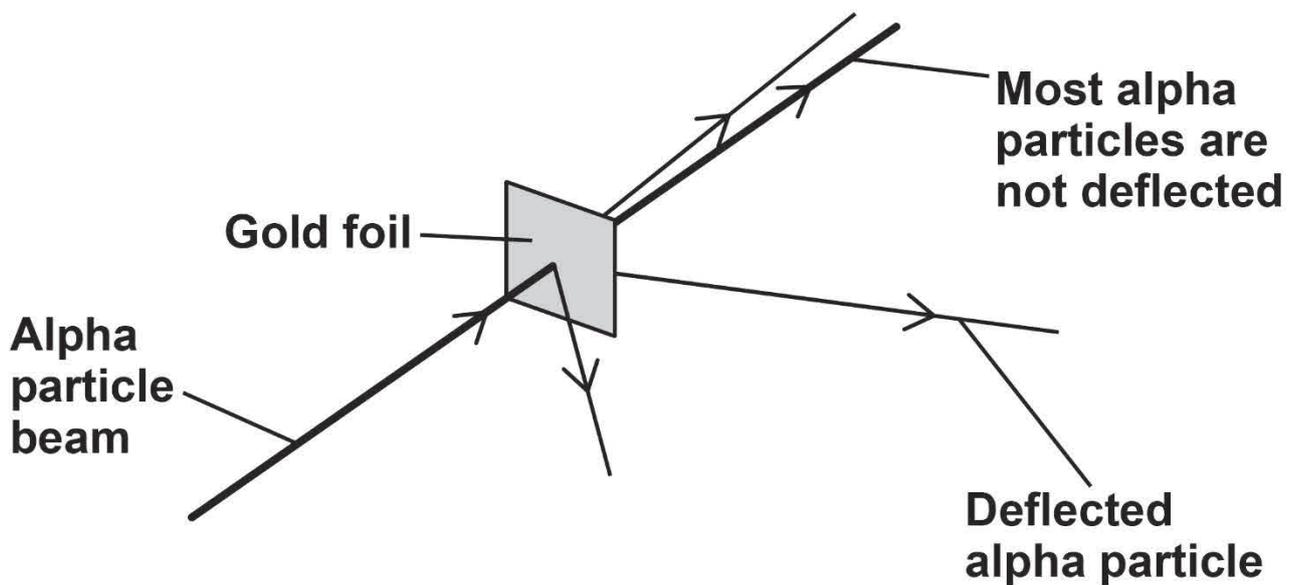**[Turn over]**

11

0 3 This question is about gold and compounds of gold.

In the alpha particle scattering experiment alpha particles are fired at gold foil.

Alpha particles are positively charged.

FIGURE 4 shows the results.

FIGURE 4

0 3 . 1 **Some alpha particles are deflected.**

Complete the sentence.

Choose the answer from the list. [1 mark]

- **negatively charged**
- **not charged**
- **positively charged**

Some alpha particles are deflected because

the nucleus of the atom is

_____ .

[Turn over]

2 1

0 3 . 2 **Why are most alpha particles NOT deflected?**
[1 mark]

Tick (✓) ONE box.

☐ **The atom is a tiny sphere that cannot be divided.**

☐ **The atom is mainly empty space.**

☐ **The electrons orbit the nucleus at specific distances.**

0 3 . 3 **What was ONE conclusion from the alpha particle scattering experiment? [1 mark]**

Tick (✓) ONE box.

☐ **The mass is concentrated at the centre of the atom.**

☐ **The mass is concentrated at the edge of the atom.**

☐ **The mass is spread evenly throughout the atom.**

Gold reacts with the elements in Group 7 of the periodic table.

0 3 . 4 What are Group 7 elements known as?
[1 mark]

Tick (✓) ONE box.

☐ Alkali metals

☐ Halogens

☐ Noble gases

[Turn over]

0 3 . 5 **Fluorine, chlorine and bromine react with gold.**

Which element will be the most reactive with gold? [1 mark]

Tick (✓) ONE box.

☐ **Fluorine**

☐ **Chlorine**

☐ **Bromine**

0 3 . 6 **3.94 g of gold reacts with chlorine to produce 6.07 g of gold chloride.**

The word equation for the reaction is:

gold + chlorine ⟶ gold chloride

Calculate the mass of chlorine that reacts with 3.94 g of gold. [1 mark]

_____

_____

_____

Mass = _____ g

[Turn over]

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0 3 . 7 **Calculate the relative formula mass (M_r) of gold chloride ($AuCl_3$).**

Relative atomic masses (A_r):
Cl = 35.5   Au = 197

[2 marks]

_____

_____

_____
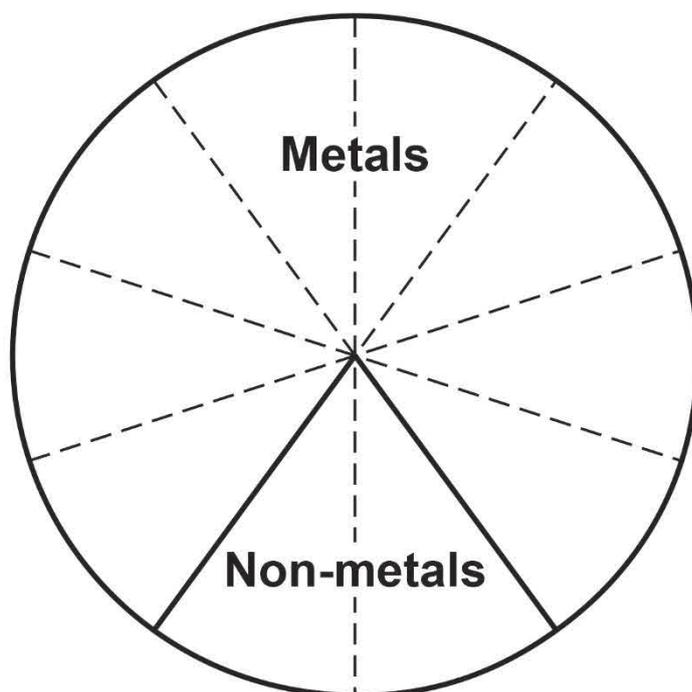
_____

_____

Relative formula mass (M_r) = _____

8

0 4 This question is about elements and compounds.

0 4 . 1 FIGURE 5 shows the proportion of elements in the periodic table that are metals and non-metals.

FIGURE 5

Determine the percentage of the elements in FIGURE 5 that are metals. [2 marks]

_____

_____

_____

Percentage = _____ %

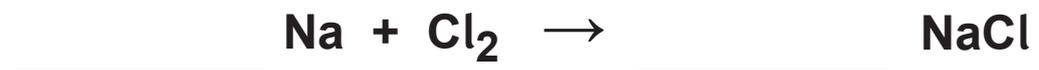0 4 . 2 **Give TWO physical properties of metals.
[2 marks]**

1 _____

_____

_____

2 _____

_____

_____

0 4 . 3 **Sodium reacts with chlorine to produce
sodium chloride.**

**Balance the equation for the reaction.
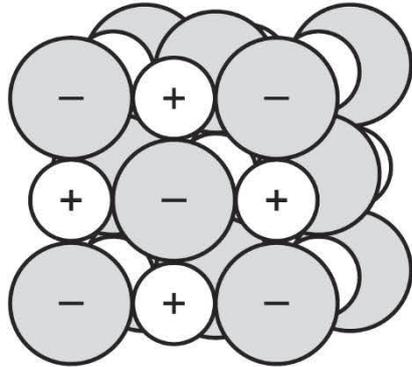[1 mark]**

_____ Na + Cl$_2$ $\longrightarrow$ _____ NaCl

[Turn over]

FIGURE 6 shows part of the structure of sodium chloride (NaCl).

FIGURE 6

Sodium chloride

0 4 . 4 **What holds the particles together in sodium chloride?**

Use FIGURE 6. [1 mark]

Tick (✓) ONE box.

☐ Electrostatic attractions

☐ Intermolecular forces

☐ Metallic bonds

0 4 . 5 **Solid sodium chloride does not conduct electricity.**

Give TWO ways in which sodium chloride can be made to conduct electricity. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

8

0 5 This question is about elements in the periodic table.

0 5 . 1 What property was used to arrange elements in early periodic tables? [1 mark]

Tick (✓) ONE box.

☐ **Atomic number**

☐ **Atomic weight**

☐ **Mass number**

0 5 . 2   In early periodic tables, iodine (I) was placed before tellurium (Te).

Mendeleev placed iodine after tellurium.

FIGURE 7 shows part of Mendeleev's periodic table.

FIGURE 7

16 O	19 F
32 S	35.5 Cl
79 Se	80 Br
128 Te	127 I

Suggest ONE reason why Mendeleev placed iodine in the column shown in FIGURE 7.
[1 mark]

_____

_____

_____

[Turn over]

TABLE 3 shows the melting points of three Group 1 metals.

TABLE 3

Metal	Melting point in °C
Lithium	180
Sodium	98
Potassium	63

0 5 . 3 **What state is lithium at 100 °C?**

Use TABLE 3. [1 mark]

Tick (✓) ONE box.

☐   **Gas**

☐   **Liquid**

☐   **Solid**

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[Turn over]

REPEAT OF TABLE 3

Metal	Melting point in °C
Lithium	180
Sodium	98
Potassium	63

0 5 . 4 **Complete the graph in FIGURE 8 on the opposite page.**

Use TABLE 3.
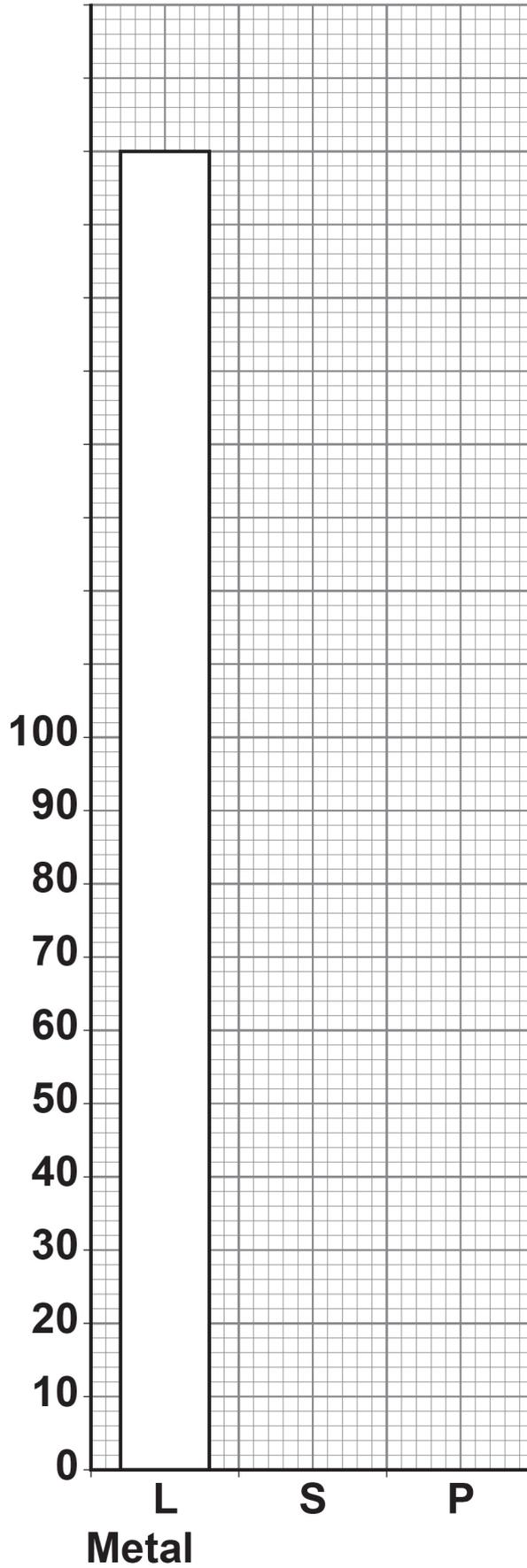
You should:

- **complete the scale on the y-axis**
- **draw bars to show the melting points of sodium and potassium.**

[3 marks]

FIGURE 8

Melting
point
in °C

KEY
L = Lithium
S = Sodium
P = Potassium

100
90
80
70
60
50
40
30
20
10
0

L   S   P

Metal

0 5 . 5 **Lithium reacts with chlorine to produce lithium chloride.**

FIGURE 9 shows what happens to the electrons in the outer shells when a lithium atom reacts with a chlorine atom.

The dots (o) and crosses (x) represent electrons.

FIGURE 9

Describe what happens to a lithium atom and to a chlorine atom when they react.

Use FIGURE 9 to answer in terms of electrons.
[3 marks]

_____

_____

_____

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_____

[Turn over]
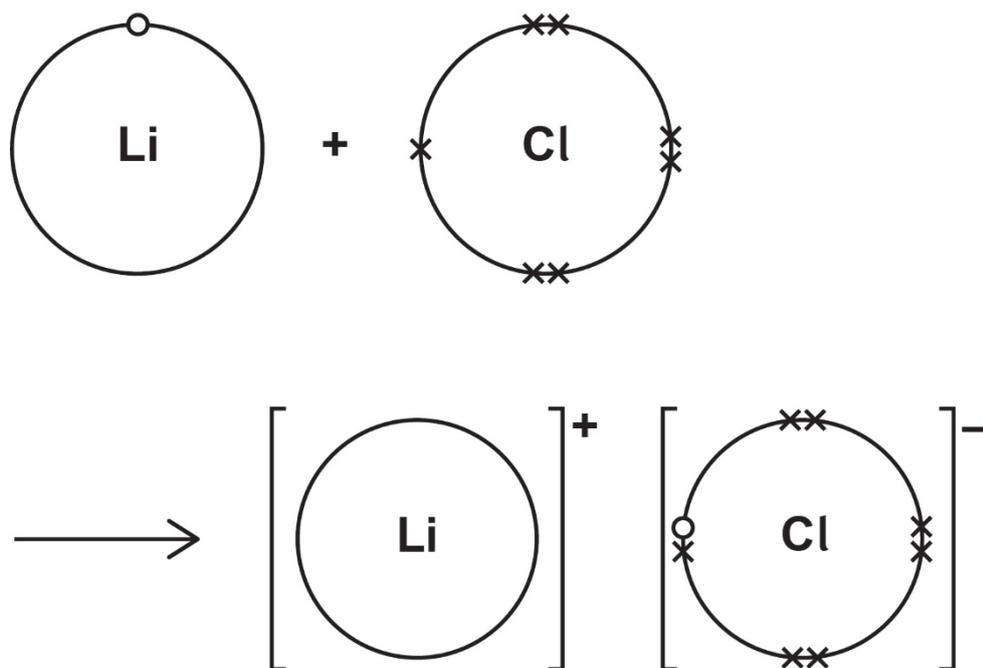
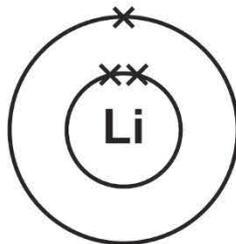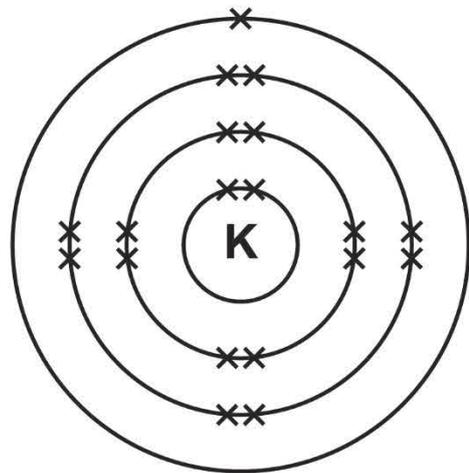**0 5 . 6** **Lithium and potassium are in the same group of the periodic table.**

FIGURE 10 represents the electronic structures of a lithium atom and of a potassium atom.

FIGURE 10

Lithium atom

Potassium atom

Give TWO reasons why potassium is more reactive than lithium. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

11

0 6 This question is about the extraction of aluminium.

0 6.**1** An aluminium atom is represented as:

$$^{27}_{13}\text{Al}$$

Give the number of electrons and neutrons in the aluminium atom. **[2 marks]**

Number of electrons _____

Number of neutrons _____

Aluminium is extracted by the electrolysis of a molten mixture of aluminium oxide and cryolite.

FIGURE 11 shows the cell used for the electrolysis.

FIGURE 11

Metal wire

Positive electrode

Molten mixture of aluminium oxide and cryolite

Negative electrode

Molten aluminium
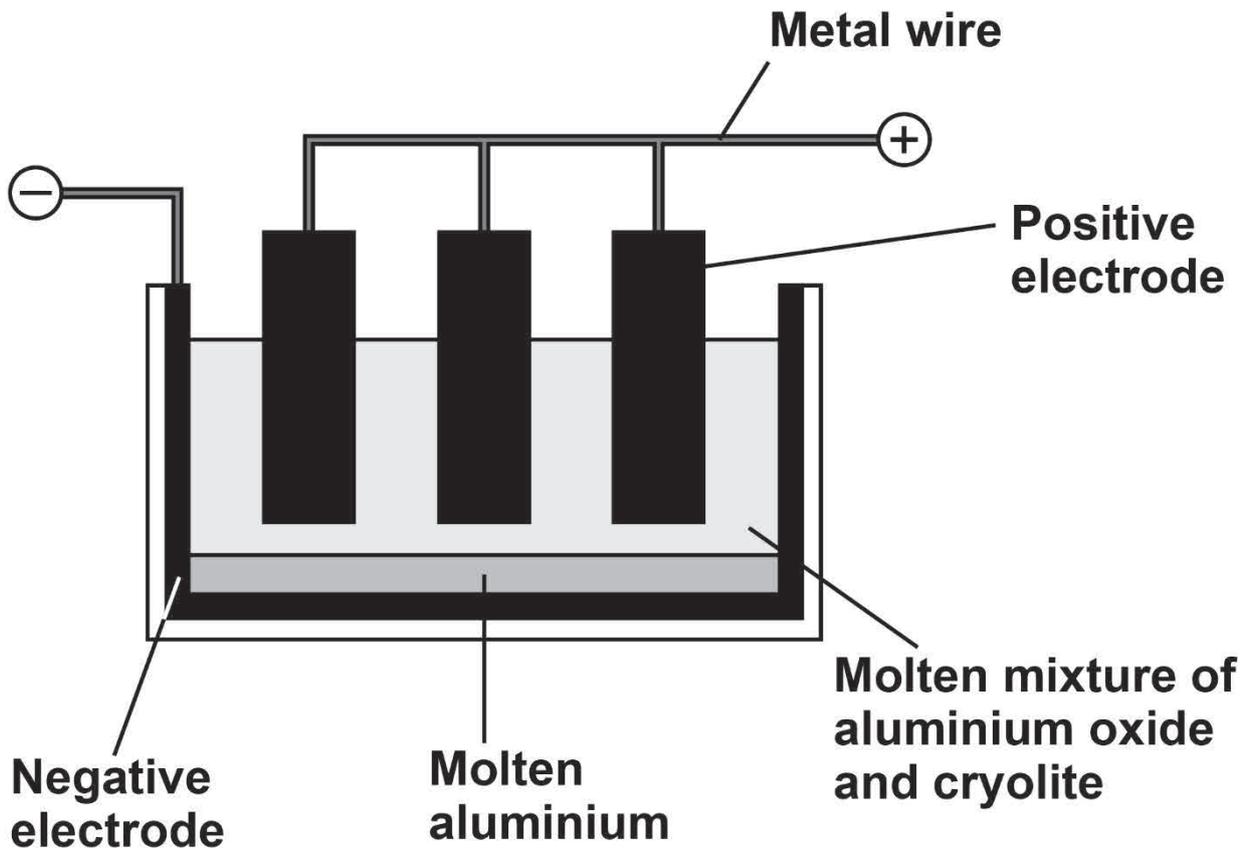
| 0 | 6 | . | 2 | **Aluminium is produced by the reduction of aluminium oxide (Al_2O_3).**

What is meant by the term reduction?
[1 mark]

_____

_____

_____

[Turn over]

0 6 . 3 **Oxygen is formed at the positive carbon electrodes.**

Explain why the positive carbon electrodes must be continually replaced. [3 marks]

_____

_____

_____

_____

_____

_____

_____

0 6 . 4 A substance conducts electricity because of free moving, charged particles.

What are the free moving, charged particles in a:

- carbon electrode (made from graphite)
- molten mixture of aluminium oxide and cryolite
- metal wire?

[3 marks]

Carbon electrode (made from graphite)

_____

Molten mixture of aluminium oxide and

cryolite _____

Metal wire _____

[Turn over]
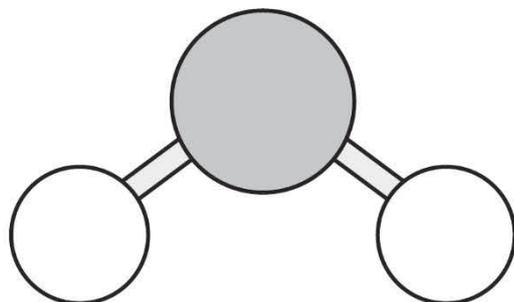
9

0 7 This question is about substances with covalent bonding.

0 7 . 1 FIGURE 12 shows a ball and stick model of a water molecule (H_2O).

FIGURE 12

Suggest ONE limitation of using a ball and stick model for a water molecule. [1 mark]

_____

_____

_____

_____

0 7 . 2 **Ice has a low melting point.**

Water molecules in ice are held together by intermolecular forces.

Complete the sentence. [1 mark]

Ice has a low melting point because the

intermolecular forces are

_____ .

[Turn over]

0 7 . 3 FIGURE 13 shows the structure of a molecule.

FIGURE 13
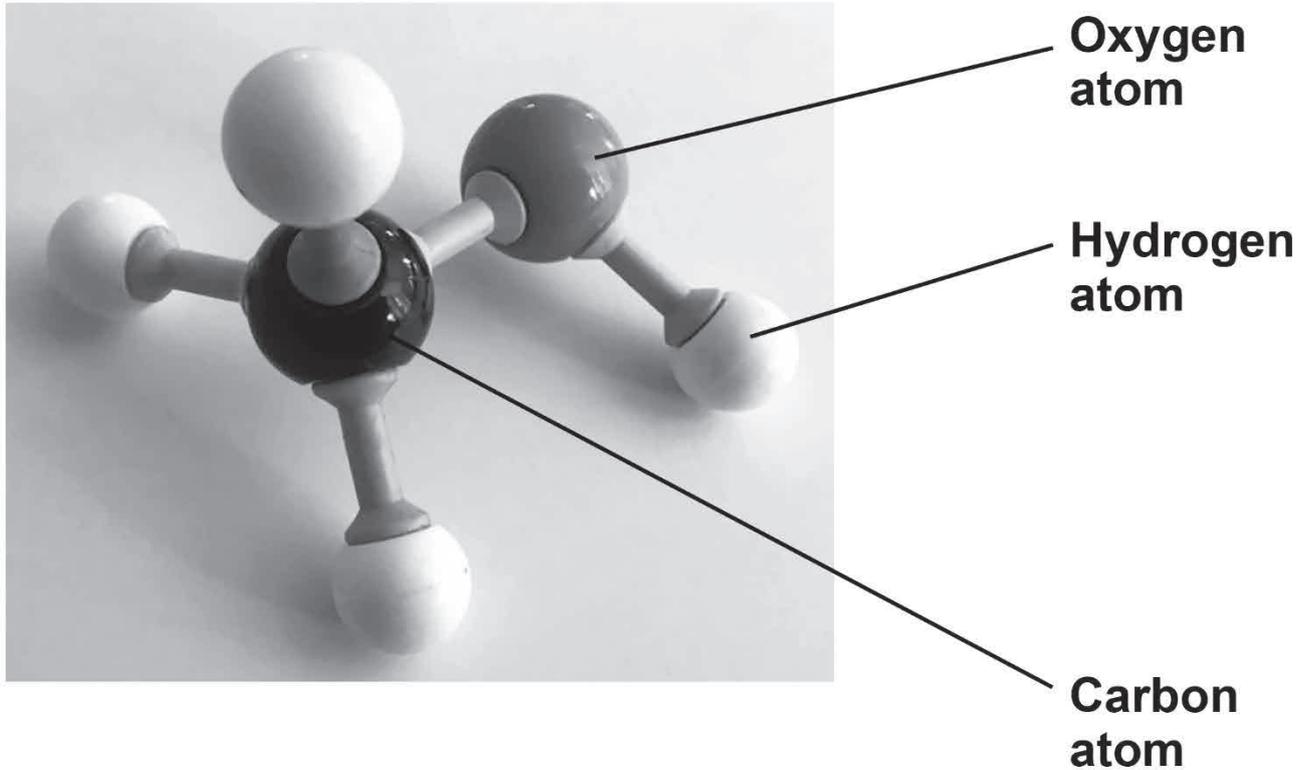
What is the molecular formula of the molecule in FIGURE 13? [1 mark]

_____

_____

_____

Diamond has a giant covalent structure.

0 7 . 4 What is the number of bonds formed by each carbon atom in diamond? [1 mark]

Tick (✓) ONE box.

☐ 2

☐ 3

☐ 4

☐ 8

0 7 . 5 Give TWO physical properties of diamond. [2 marks]

1 _____

_____

2 _____

_____

[Turn over]

0 7 . 6 **Name TWO other substances with giant covalent structures. [2 marks]**

1 _____

_____

2 _____

_____

8

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[Turn over]

0 8 Some students investigated the thermal decomposition of metal carbonates.

The word equation for the reaction is:

metal carbonate

$\longrightarrow$ metal oxide + carbon dioxide

The students made the following hypothesis:

'When heated the same mass of any metal carbonate produces the same mass of carbon dioxide.'

The students heated a test tube containing copper carbonate.

TABLE 4 shows their results.

TABLE 4

Time the test tube containing copper carbonate was heated in mins	0	2	4	6
Mass of test tube and contents in g	17.7	17.1	17.0	17.0

Plan a method the students could use to test their hypothesis.

You should show how the students use their results to test the hypothesis.

You do NOT need to write about safety precautions. [6 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Turn over]

END OF QUESTIONS

6

Additional page, if required.

Write the question numbers in the left-hand margin.

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

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

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