# AQA

# 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 | |

| 0 | 1 | Magnesium is in Group 2 of the periodic table.

1.0 g of magnesium reacted with chlorine to produce magnesium chloride.

| 0 | 1 | . | 1 | Which types of element react when magnesium reacted with chlorine?

[1 mark]

Tick (✓) one box.

A metal and a metal ☐

A metal and a non-metal ☑

A non-metal and a non-metal ☐

| 0 | 1 | . | 2 | Write the word equation for the reaction when magnesium reacts with chlorine.

[1 mark]

Magnesium    +    Chlorine    →    Magnesium Chloride

| 0 | 1 | . | 3 | What apparatus was used to measure the mass of 1.0 g of magnesium?

[1 mark]

Tick (✓) one box.

Balance ☑

Beaker ☐

Ruler ☐

0 1 . 4    What mass of magnesium chloride was produced?

**[1 mark]**

Tick (✓) **one** box.

Less than 1.0 g    ☐

1.0 g    ☐

More than 1.0 g    ☑

0 1 . 5    Magnesium reacts with oxygen to produce magnesium oxide.

Calculate the percentage mass of magnesium in magnesium oxide (MgO).

Relative atomic mass ($A_r$):    Mg = 24

Relative formula mass ($M_r$):    MgO = 40

**[2 marks]**

$$\text{Mass MgO} = 40 \qquad \text{Mass Mg} = 24$$

$$\frac{\text{Portion}}{\text{Total}} \times 100 = \text{Percent} \qquad \frac{24}{40} \times 100 = 60\%$$

Percentage mass of magnesium = ___60%___ %

**Question 1 continues on the next page**

Magnesium carbonate decomposes to produce magnesium oxide and carbon dioxide.

The word equation for the reaction is:

magnesium carbonate → magnesium oxide + carbon dioxide

Four students heated 2.00 g of magnesium carbonate for 10 minutes.

Table 1 shows the results.

Table 1

| | Mass of carbon dioxide produced in g | | | |
|---|---|---|---|---|
| Student 1 | Student 2 | Student 3 | Student 4 | Mean |
| 0.97 | 0.91 | 0.50 | 0.95 | X |

0 1 . 6  What is the most likely reason for Student 3's anomalous result?

**[1 mark]**

Tick (✓) one box.

The student heated more than 2.00 g of magnesium carbonate. ☐

The student heated the magnesium carbonate for less than 10 minutes. ☑

The student used a higher temperature. ☐

0 1 . 7  Calculate value X in Table 1.

Do **not** use the anomalous result.

Give your answer to 2 significant figures.

**[3 marks]**

$$Mean = \frac{Value\ 1 + Value\ 2 + Value\ 3 \ldots}{Total\ of\ values}$$

$$Mean = \frac{0.97 + 0.91 + 0.95}{3} = 0.94\ g$$

X (2 significant figures) = __0.94__ g

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

**0 2** This question is about electrolysis.

**0 2 . 1** Complete the sentence.

Choose the answer from the box.

[1 mark]

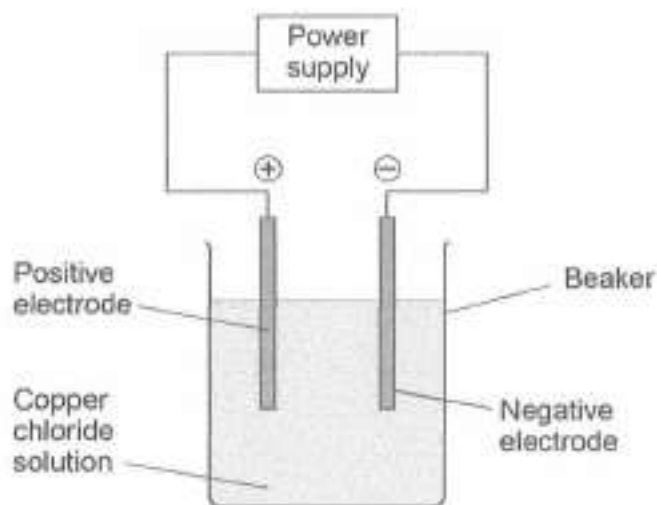| gaseous | molten | solid |

Copper chloride can conduct electricity when in solution or

when _____ Molten _____.

Figure 1 shows the apparatus used for the electrolysis of copper chloride solution.

**Figure 1**



There are four ions in copper chloride solution:

- $Cu^{2+}$

- $Cl^-$

- $H^+$

- $OH^-$

**0 2 . 2** Why do Cl⁻ ions and OH⁻ ions move to the positive electrode?

[1 mark]

Because they are negatively charged and opposite charges attract one another

**0 2 . 3** Where do the H⁺ and OH⁻ ions come from in the electrolysis of copper chloride solution?

[1 mark]

Tick (✓) **one** box.

Air ☐

Copper chloride ☐

Water ☑

**0 2 . 4** Which ion produces a metal?

[1 mark]

Tick (✓) **one** box.

$Cu^{2+}$ ☑
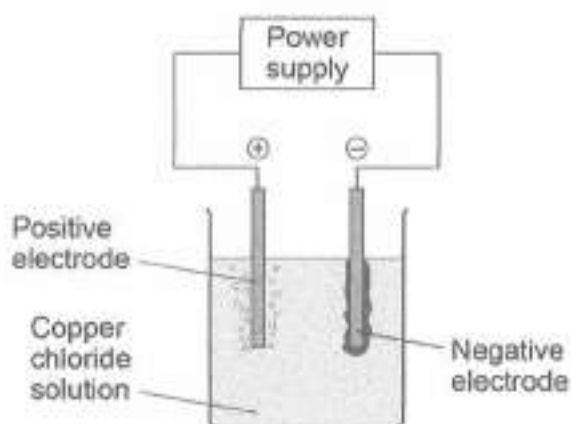
$Cl^-$ ☐

$H^+$ ☐

$OH^-$ ☐

**Question 2 continues on the next page**

Turn over ▶

**0 2 . 5** Figure 2 shows the apparatus during the electrolysis of copper chloride solution.

**Figure 2**



Describe what is seen at each electrode during the electrolysis of copper chloride solution.

[2 marks]

Positive electrode ___Bubbles of Gas are produced___

Negative electrode ___Solid Copper builds up___

**0 2 . 6** 500 cm³ of copper chloride solution contains 6.50 g of copper chloride.

Calculate the mass of copper chloride in 40.0 cm³ of this copper chloride solution.

[2 marks]

Mass per cm³ = $\frac{6.50}{500}$ = 0.013 g/cm

Mass in 40.cm³ = 40 × 0.013

= 0.52 g        Mass = ___52___ g

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**0 3** Carbon can exist in a number of different structures.

**0 3 . 1** What is the approximate radius of a carbon atom?

[1 mark]

Tick (✓) one box.
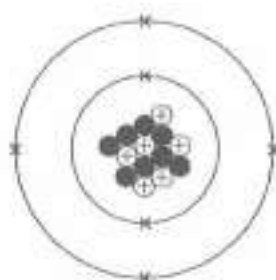
0.1 m ☐          0.1 mm ☐          0.1 nm ☑

**0 3 . 2** Figure 3 shows an atom of carbon.

Figure 3



Describe the atomic structure of this carbon atom.

You should include the number of electrons, neutrons and protons.

[6 marks]

In the centre of the atom is the nucleus. It is made up of 6 positive protons and 8 neutral neutrons.

The nucleus is surrounded by 6 electrons. These electrons are arranged in two shells. Two electrons are in the inner shell and 4 in the outer shell.
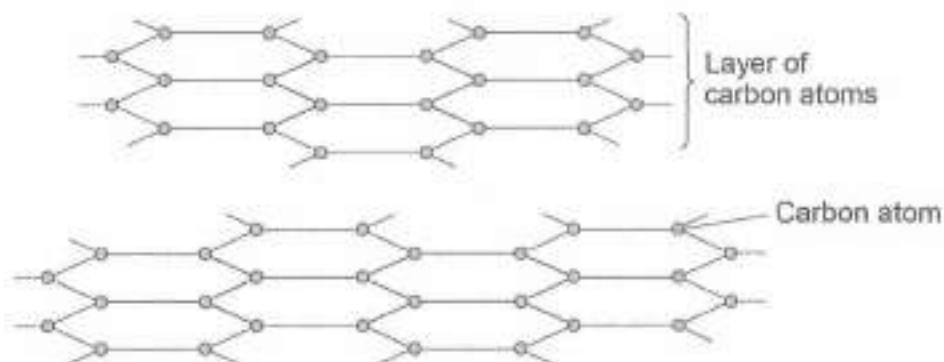
It's electronic structure is 2,4

Turn over ▶

In graphite the carbon atoms are held together by bonds.

Figure 4 represents part of the structure of graphite.

**Figure 4**



Layer of carbon atoms

Carbon atom

0 3 . 3   How many bonds does each carbon atom have in graphite?

Use **Figure 4**.

[1 mark]

Tick (✓) **one** box.

1 [ ]   2 [ ]   3 [✓]   4 [ ]

0 3 . 4   What type of bonds hold the carbon atoms together in graphite?

[1 mark]

Tick (✓) **one** box.

Covalent [✓]

Ionic [ ]

Metallic [ ]

**0 3 . 5** Lubricants allow objects to slide over each other easily.

Suggest why graphite can be used as a lubricant.

Use **Figure 4**.

[1 mark]

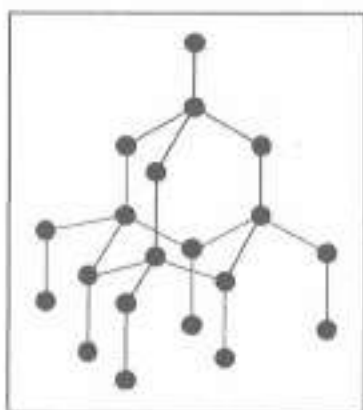*Each graphite layer con side over
the others.*

**0 3 . 6** The two structures represent different forms of carbon.

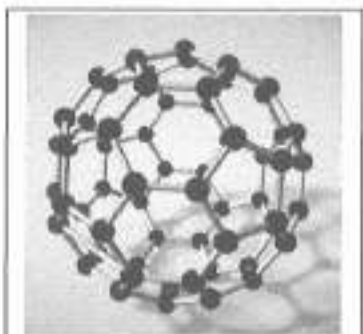Draw **one** line from each structure to the form of carbon.

[2 marks]

| Structure | Form of carbon |
|---|---|



Buckminsterfullerene

Diamond

Graphene

Nanotube

12

| 0 | 4 | | Sodium and potassium are Group 1 elements.

| 0 | 4 |.| 1 | What is the name of Group 1 elements?

[1 mark]

Tick (✓) one box.

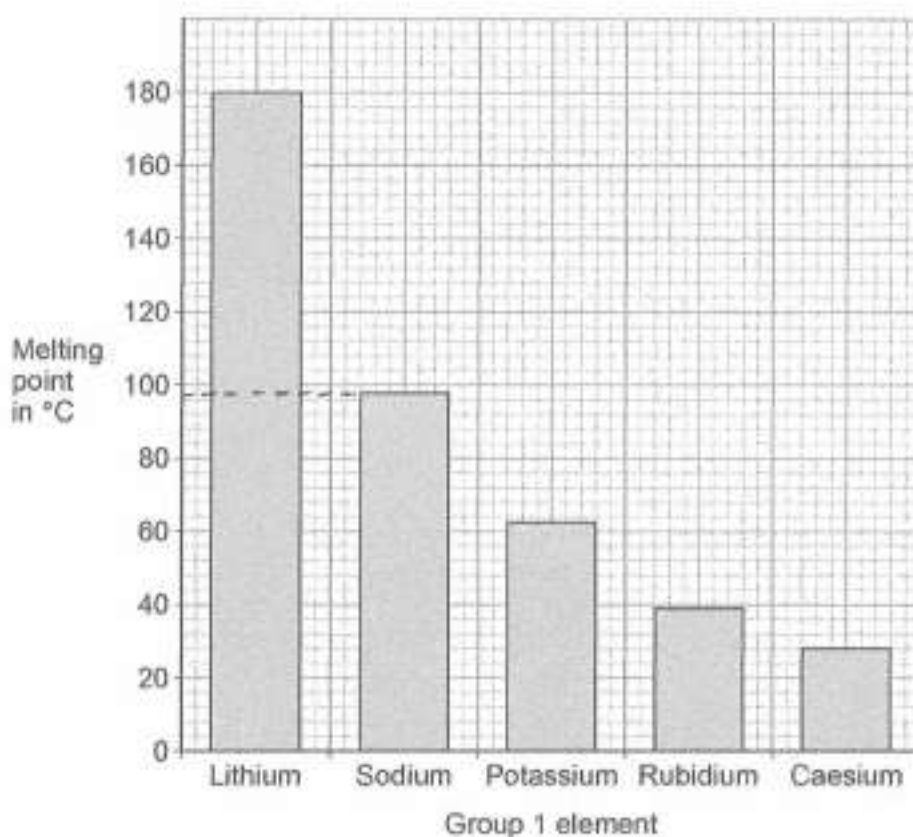Alkali metals ✓

Halogens ☐

Noble gases ☐

0 4 . 2 Figure 5 represents the melting points of Group 1 elements.

**Figure 5**
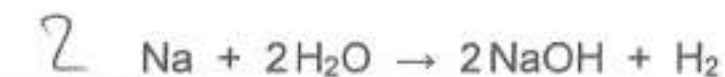


What is the melting point of sodium?

[1 mark]

Melting point of sodium = _98_ °C

0 4 . 3 Sodium reacts with water to produce sodium hydroxide and hydrogen.

Balance the equation for the reaction.

[1 mark]

$$\underline{2}\ Na + 2H_2O \rightarrow 2NaOH + H_2$$

**Turn over ▶**

0 4 . 4 Calculate the relative formula mass ($M_r$) of sodium hydroxide (NaOH).

Relative atomic masses ($A_r$):   H = 1   O = 16   Na = 23

[2 marks]

$$M_r \, NaOH = M_H + M_O + M_{Na}$$
$$= 1 + 16 + 23$$
$$= 40$$

Relative formula mass ($M_r$) = _40_

0 4 . 5 Sodium and potassium both react with water.

**Figure 6** shows sodium reacting with water.

**Figure 6**



Compare what is seen when sodium reacts with water and when potassium reacts with water.

[4 marks]

The sodium will float on top of the water. It will react with the water and move about on the surface. It will fizz and eventually melt away. Like Sodium, Potassium will float on top of the water. However it will react more vidently. This means it will move faster and fizz more. It will also catch fire, burning with a lilac flame

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**Turn over for the next question**

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ANSWER IN THE SPACES PROVIDED

**Turn over ▶**

**0 5**

A student investigated the change in temperature when different masses of zinc were added to copper sulfate solution.

This is the method used.

1. Measure the volume of copper sulfate solution using a measuring cylinder.

2. Pour the copper sulfate solution into a metal container.

3. Add 2 g of zinc.

4. Measure the temperature of the solution.

5. Repeat steps 1 to 4 with different masses of zinc.
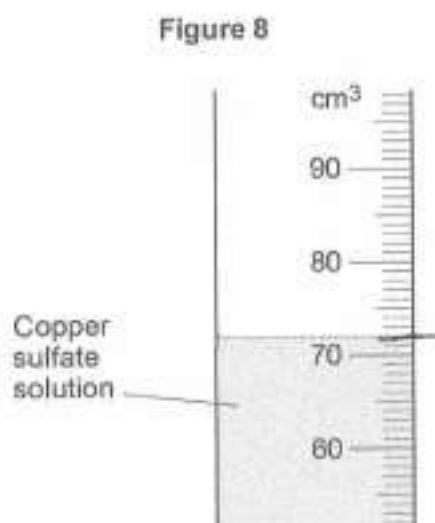
Figure 7 shows the apparatus.

**Figure 7**
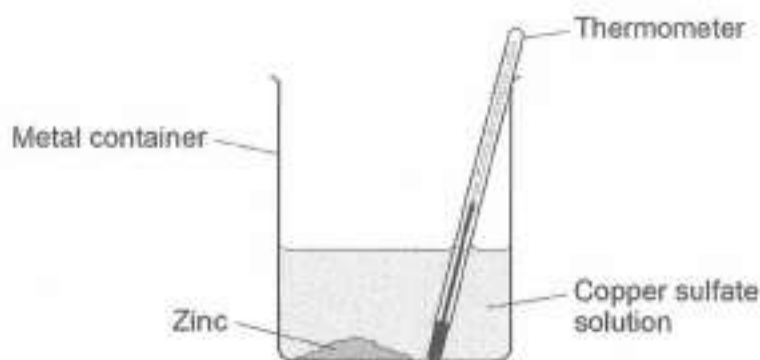


**0 5 . 1**    Give **three** improvements to the investigation to make the results more accurate.

[3 marks]

1  Use a polystyrene cup to prevent heat loss

2  Reapet the experiment multiple times and take the mean of the results

3  Put a metal lid on top to keep heat in

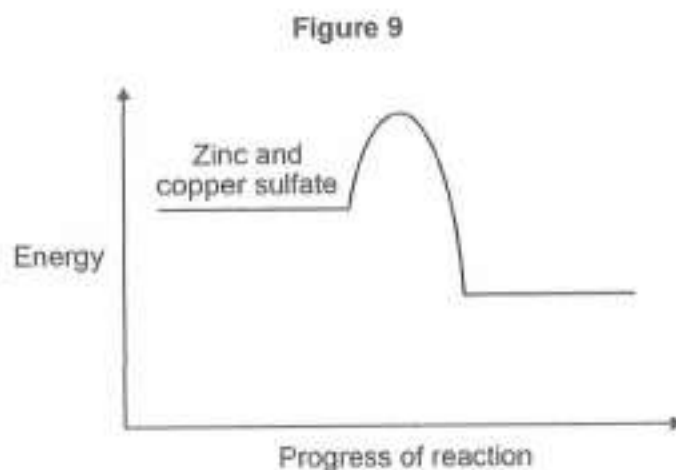**0 5 . 2** Figure 8 shows part of the measuring cylinder.

Figure 8



What is the volume of copper sulfate solution in **Figure 8**?

[1 mark]

Volume = _____72_____ cm³

**0 5 . 3** When zinc was added to copper sulfate solution the temperature increased.

**Figure 9** shows the reaction profile.

Figure 9



What type of reaction is shown in **Figure 9**?

[1 mark]

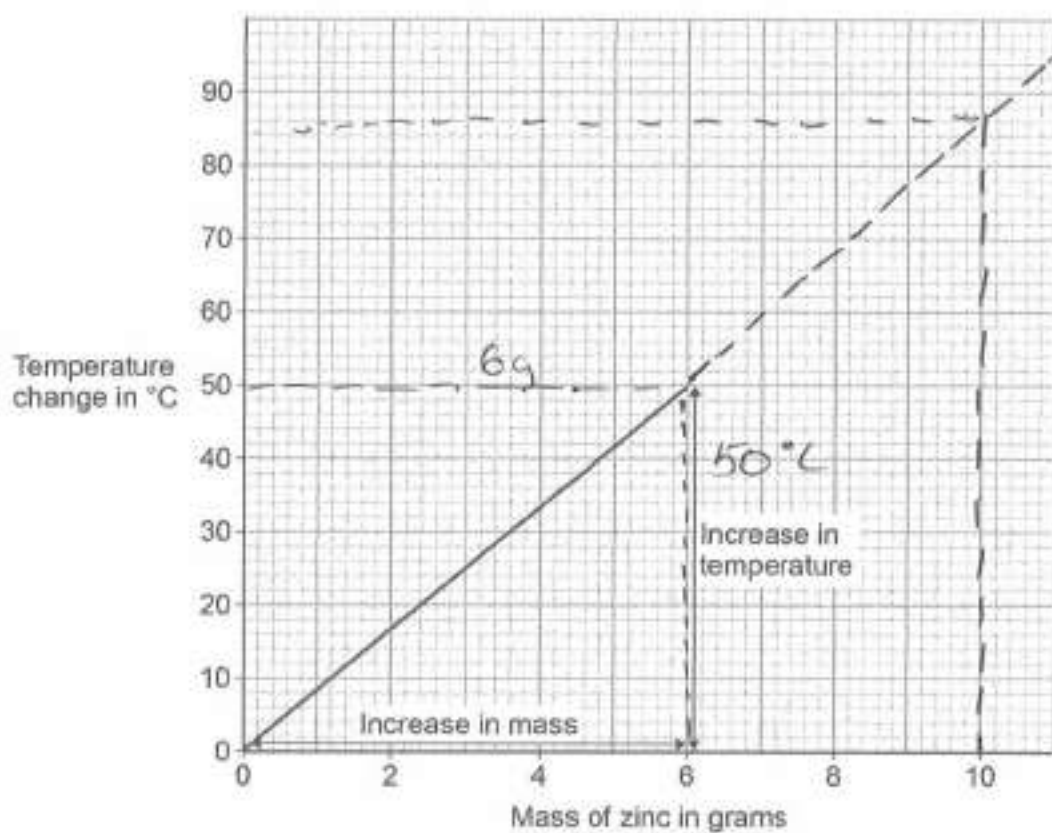Tick (✓) **one** box.

Endothermic ☐     Exothermic ✓     Neutralisation ☐

**Turn over ▶**

Figure 10 shows the results.

**Figure 10**

**0 5 . 4** Determine the gradient of the line in **Figure 10**.

Use the equation:

$$\text{gradient} = \frac{\text{increase in temperature in °C}}{\text{increase in mass in grams}}$$

[4 marks]

(Change in Temperature)

$\Delta T = 50°C$    Change in Mass 6g

$\text{gradient} = \frac{50}{6} = 8.33 °C/g$

Gradient = _**8.33**_ °C per g

**0 5 . 5** Suggest why the student should **not** use more than 10 g of zinc.

Use **Figure 10**.

You should extend the graph line.

[2 marks]

It more than 10 g of the temperature of the reaction will exceed 100°C, boiling the water.

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**Turn over for the next question**

| 0 | 6 | This question is about the periodic table.

| 0 | 6 |. | 1 | **Figure 11** shows part of Mendeleev's version of the periodic table.

**Figure 11**

| H | | | | | | | |
|---|---|---|---|---|---|---|---|
| Li | Be | B | C | N | O | F | |
| Na | Mg | Al | Si | P | S | Cl | |
| K  Cu | Ca  Zn | | Ti | V  As | Cr  Se | Mn  Br | Fe Co Ni |
| Rb  Ag | Sr  Cd | Y  In | Zr  Sn | Nb  Sb | Mo  Te | I | Ru Rh Pd |

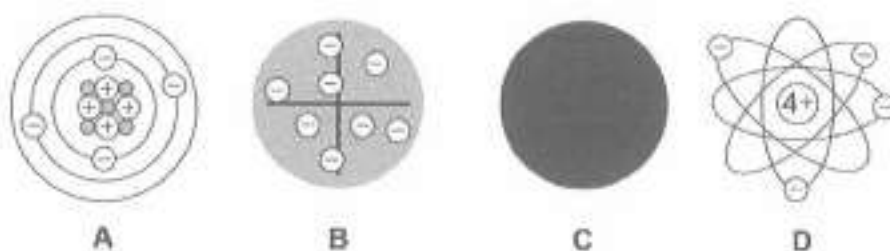Which group of elements had **not** been discovered when Mendeleev's version of the periodic table was published?

[1 mark]

Group O, the Nobel Gasses.

Figure 12 represents different models of the atom.

**Figure 12**



A      B      C      D

| 0 | 6 | . | 2 | Which model represents the plum pudding model?

[1 mark]

Tick (✓) one box.

A ☐      B ☑      C ☐      D ☐

| 0 | 6 | . | 3 | Which model resulted from Chadwick's experimental work?

[1 mark]

Tick (✓) one box.

A ☑      B ☐      C ☐      D ☐

**Question 6 continues on the next page**

Potassium has different isotopes.

**0 6 . 4** What is meant by 'isotopes'?

You should refer to subatomic particles.

[2 marks]

Isotopes are atoms that have the Same
number of protons in their nucleus as
another but a different number of
neutrons

**0 6 . 5** **Table 2** shows the mass numbers and the percentage abundance of two
isotopes of potassium.

**Table 2**

| Mass number | Percentage abundance |
|---|---|
| 39 | 93.1 |
| 41 | 6.9 |

Calculate the relative atomic mass ($A_r$) of potassium.

Give your answer to 1 decimal place.

[3 marks]

$$A_r = \frac{(39 \times 93.1) + (41 \times 6.9)}{100}$$

$$= 39.1$$

Relative atomic mass (1 decimal place) = **39.1**

8

Turn over for the next question

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**Turn over ▶**

**0 7** Acids react to produce salts.

Universal indicator is added to water and then nitric acid is added to the mixture.

**0 7 . 1** Give the colour change when nitric acid is added to the mixture of universal indicator and water.

**[1 mark]**

Tick (✓) **one** box.

Blue to red ☐

Green to purple ☐

Green to red ☑

Red to purple ☐

**0 7 . 2** What happens to the pH of water when nitric acid is added?

**[1 mark]**

Tick (✓) **one** box.
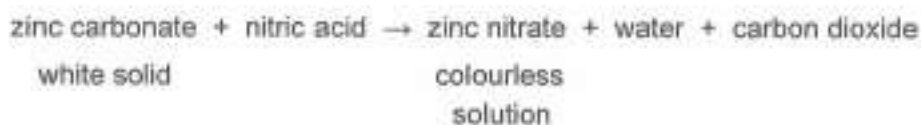
Decreases ☑

Stays the same ☐

Increases ☐

**0 7 . 3** What is the state symbol for nitric acid?

**[1 mark]**

(aq)

Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:

zinc carbonate + nitric acid → zinc nitrate + water + carbon dioxide
white solid                  colourless
                              solution

| 0 | 7 | . | 4 | Give **two** observations that would be made when zinc carbonate is added to nitric acid until the zinc carbonate is in excess.

[2 marks]

1 _Fizzing_

2 _White solid left at the bottom_

| 0 | 7 | . | 5 | The formula of the zinc ion is $Zn^{2+}$

The formula of the nitrate ion is $NO_3^-$

What is the formula for zinc nitrate?

[1 mark]

Tick (✓) **one** box.

$ZnNO_3$    ☐

$Zn(NO_3)_2$    ☑

$Zn_2NO_3$    ☐

$Zn_2(NO_3)_2$    ☐

**Question 7 continues on the next page**

**Turn over ▶**

0 7 . 6   Acids react with insoluble metal oxides to produce salts.

Plan a method to produce a pure, dry sample of the soluble salt copper chloride from an acid and a metal oxide.

[6 marks]

A Solution of hydrochloric acid should be poured into a beaker. To this a sample of copper oxide should be added. This sample should be added to until the copper oxide is in excess. This should be stirred and then the mixture filtered to remove the excess copper oxide. The remaining solution then goes into an evaporating dish. This is gently heated with a water bath or electric heater. This will evaporate the remaining solution, leaving dry crystals of pure copper chloride.

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END OF QUESTIONS

There are no questions printed on this page

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