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.

*Do not write outside the box*

**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]**

_____ + _____ → _____

**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 ☐

*Do not write outside the box*

**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]**

Percentage mass of magnesium = _____ %

**Question 1 continues on the next page**

*Do not write outside the box*

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]**

**X** (2 significant figures) = _____ g

**10**

*Do not write outside the box*

**Turn over for the next question**

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

*Do not write outside the box*

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

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

Choose the answer from the box.

**[1 mark]**

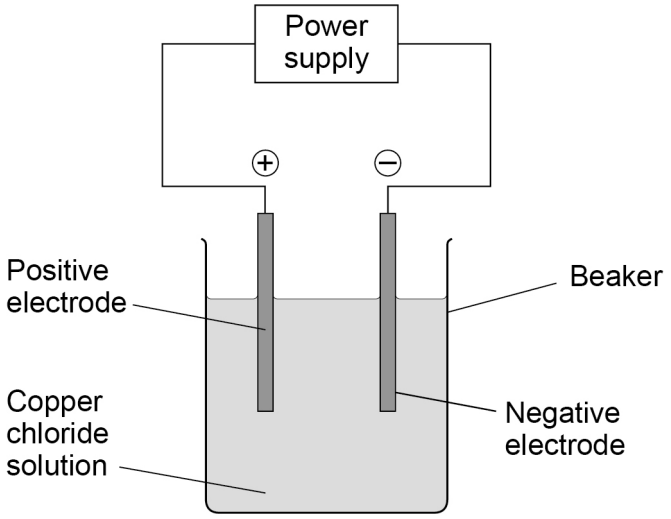
| | | |
|---|---|---|
| **gaseous** | **molten** | **solid** |

Copper chloride can conduct electricity when in solution or

when _____ .

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

**Figure 1**




There are four ions in copper chloride solution:

- $Cu^{2+}$
- $Cl^{-}$
- $H^{+}$
- $OH^{-}$

*Do not write outside the box*

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

**[1 mark]**

**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**

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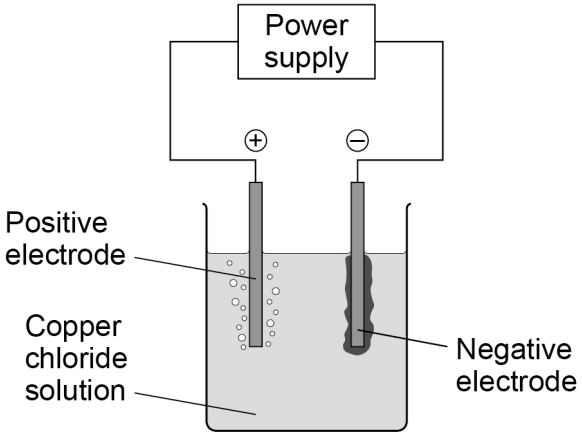
**0 2 . 5** **Figure 2** shows the apparatus during the electrolysis of copper chloride solution.

**Figure 2**




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

**[2 marks]**

Positive electrode _____

_____

Negative electrode _____

_____

**0 2 . 6** 500 $cm^3$ of copper chloride solution contains 6.50 g of copper chloride.

Calculate the mass of copper chloride in 40.0 $cm^3$ of this copper chloride solution.

**[2 marks]**

_____

_____

_____

Mass = _____ g

**8**

*Do not write outside the box*

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

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

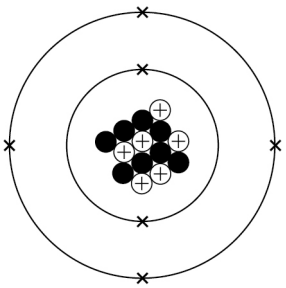
**[1 mark]**

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.

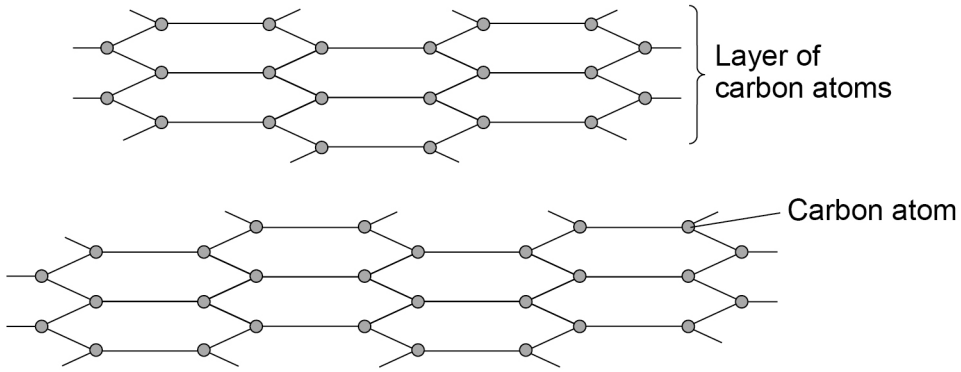
**[6 marks]**

*Do not write outside the box*

In graphite the carbon atoms are held together by bonds.

**Figure 4** represents part of the structure of graphite.

**Figure 4**




**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 ☐

*Do not write outside the box*

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

Suggest why graphite can be used as a lubricant.

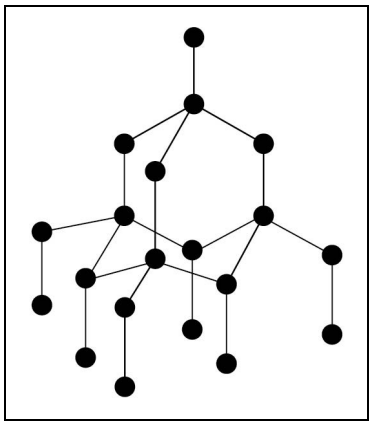
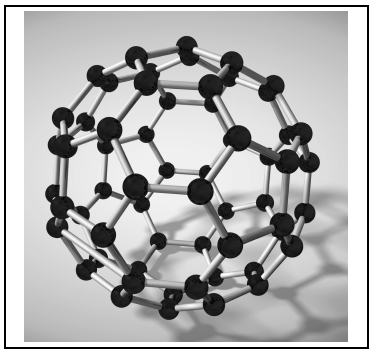
Use **Figure 4**.

**[1 mark]**

**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**

*Do not write outside the box*

**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 ☐

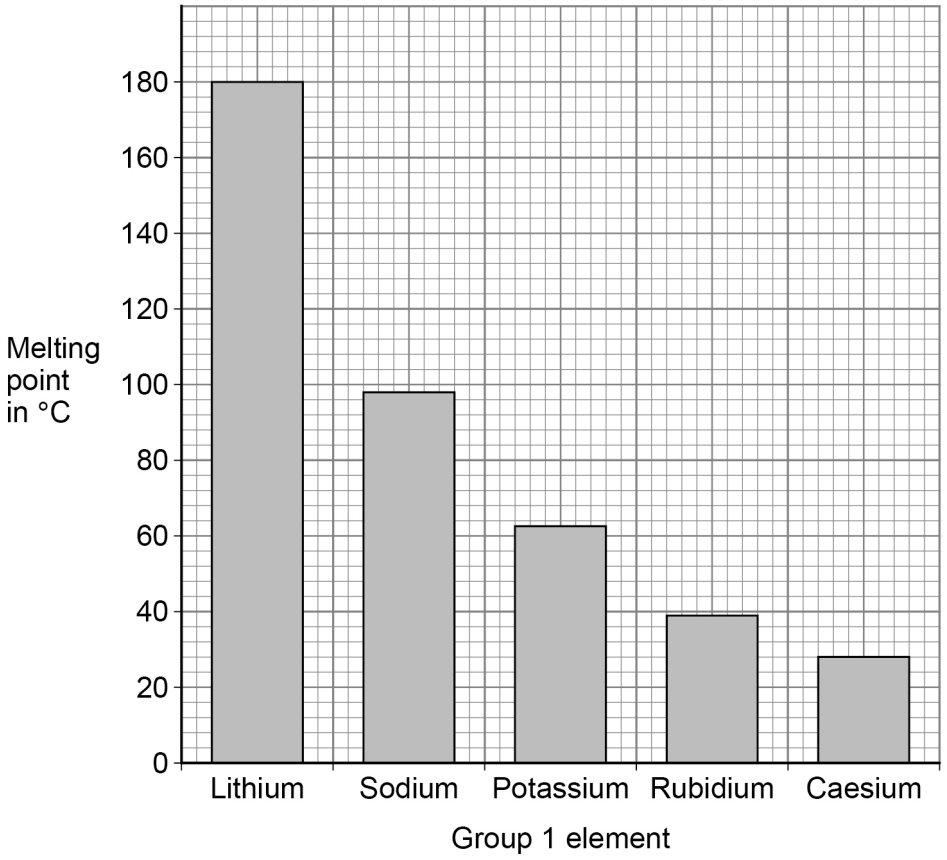
Halogens ☐

Noble gases ☐

*Do not write outside the box*

**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 = _____ °C

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

Balance the equation for the reaction.

**[1 mark]**

$$\_\_\_\_\_\ Na + 2H_2O \rightarrow 2NaOH + H_2$$

Do not write outside the box

**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

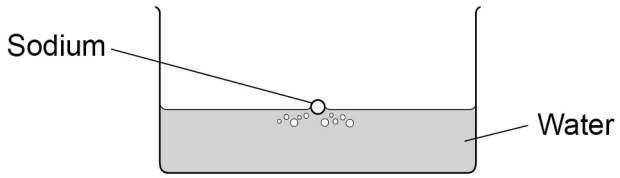
**[2 marks]**

Relative formula mass ($M_r$) = _____

**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]**

9

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**Turn over for the next question**

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**ANSWER IN THE SPACES PROVIDED**

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**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.

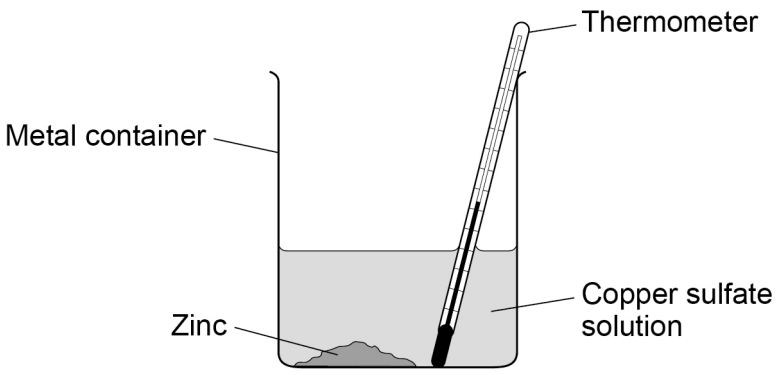
3. Add 2 g of zinc.

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 _____

_____

2 _____

_____

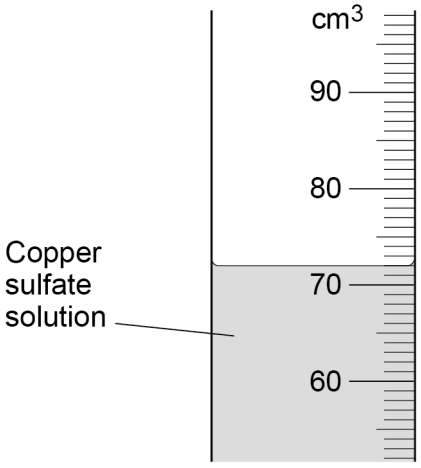
3 _____

_____

*Do not write outside the box*

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

**Figure 8**




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

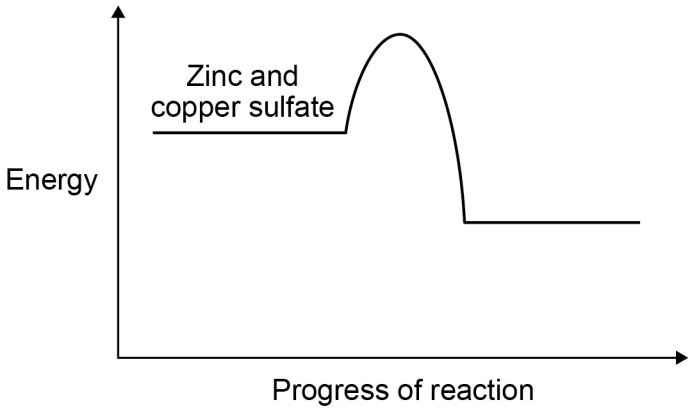
**[1 mark]**

Volume = _____ $cm^3$

**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]**

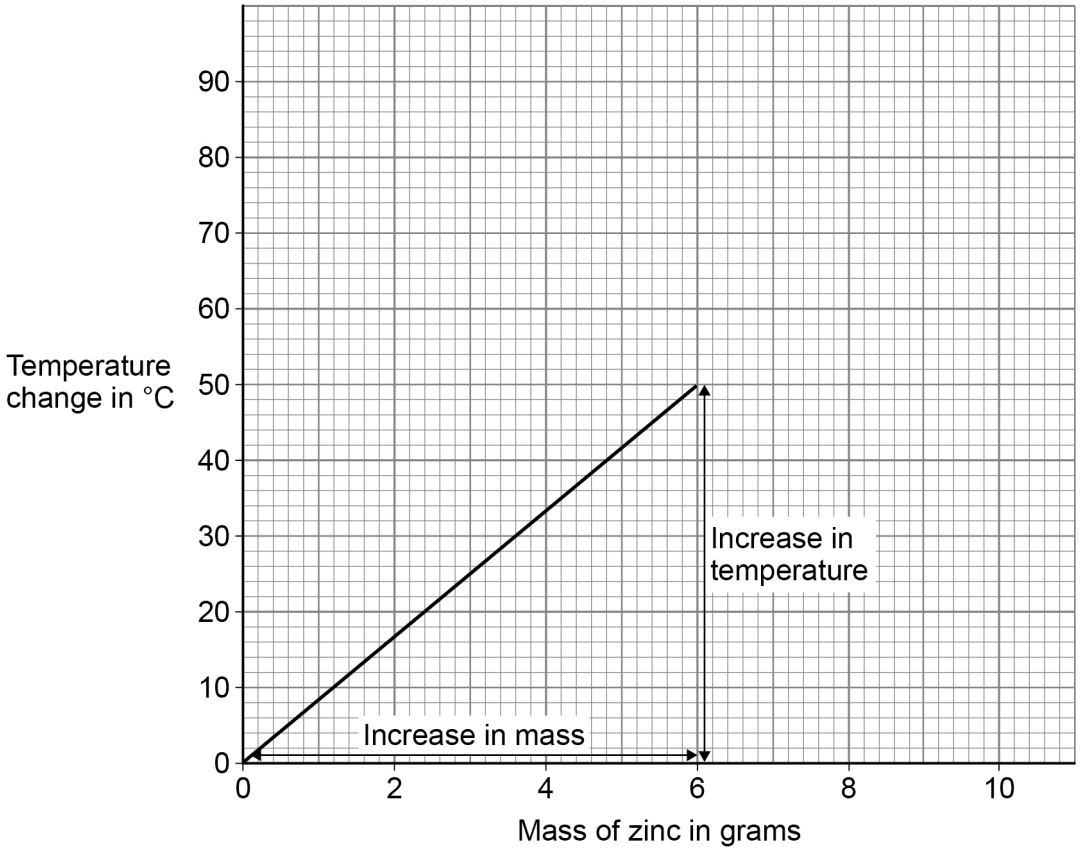
Tick (✓) **one** box.

Endothermic ☐ Exothermic ☐ Neutralisation ☐

*Do not write outside the box*

**Figure 10** shows the results.

**Figure 10**



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**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]**

Gradient = _____ °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]**

11

**Turn over for the next question**

*Do not write outside the box*

**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?

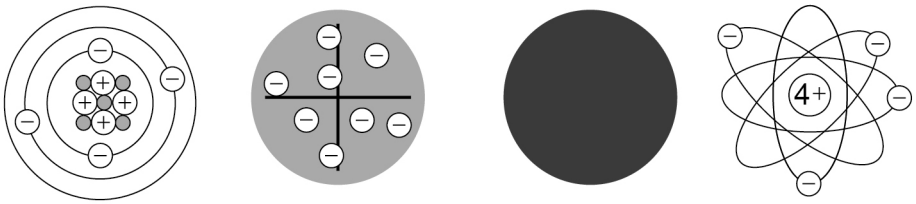
**[1 mark]**

_____

*Do not write outside the box*

**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**

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Potassium has different isotopes.

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

You should refer to subatomic particles.

**[2 marks]**

**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]**

Relative atomic mass (1 decimal place) = _____

**8**

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**Turn over for the next question**

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**ANSWER IN THE SPACES PROVIDED**

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**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]**

_____

*Do not write outside the box*

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 _____

_____

2 _____

_____

**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**

Do not write outside the box

**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]**

12

**END OF QUESTIONS**

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