

Surname _____

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GCSE

F

COMBINED SCIENCE: TRILOGY

Foundation Tier

Chemistry Paper 1F

8464/C/1F

Thursday 17 May 2018 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]



For this paper you must have:

- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed).**

INSTRUCTIONS

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided.**
- **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**



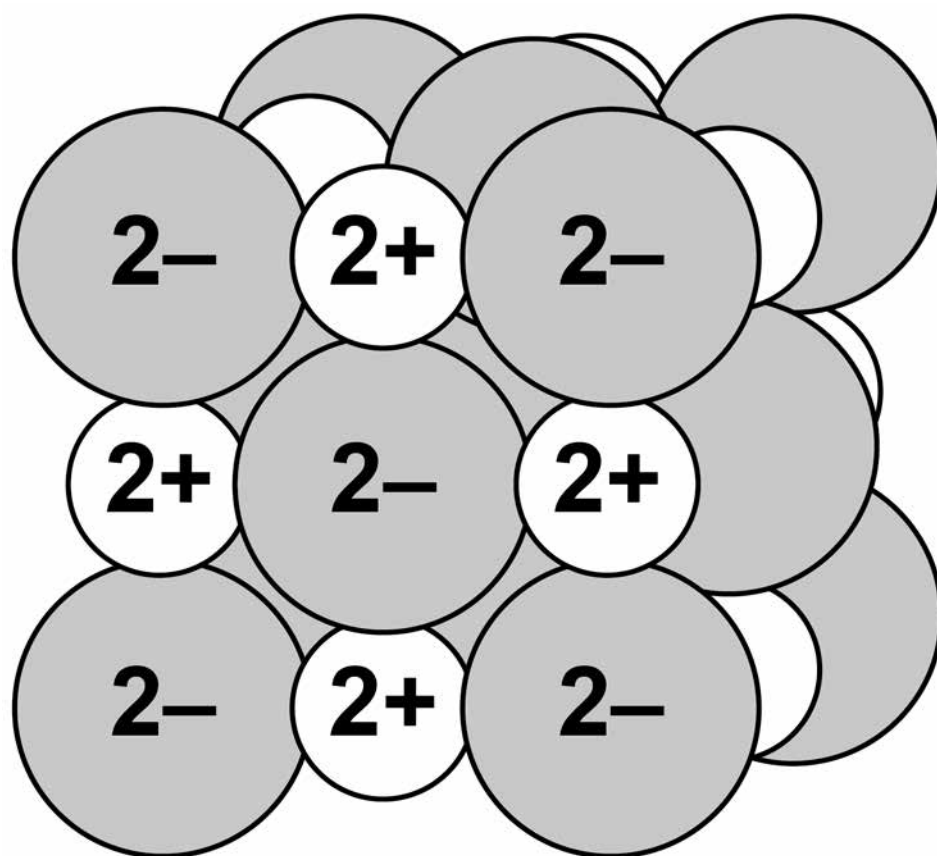
0 1

This question is about structure and bonding.

0 1**. 1**

FIGURE 1 shows part of the structure of calcium oxide (CaO).

FIGURE 1



5

What type of bonding is present in calcium oxide? [1 mark]

Tick ONE box.

Covalent

Ionic

Macromolecular

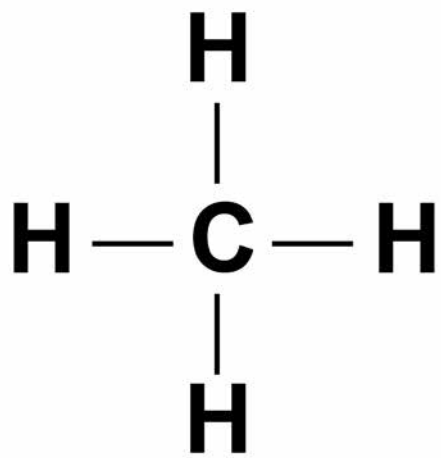
Metallic

[Turn over]



01.2 FIGURE 2 shows a particle of methane (CH₄).

FIGURE 2



7

What type of particle is present in FIGURE 2? [1 mark]

Tick ONE box.

An ion

A lattice

A molecule

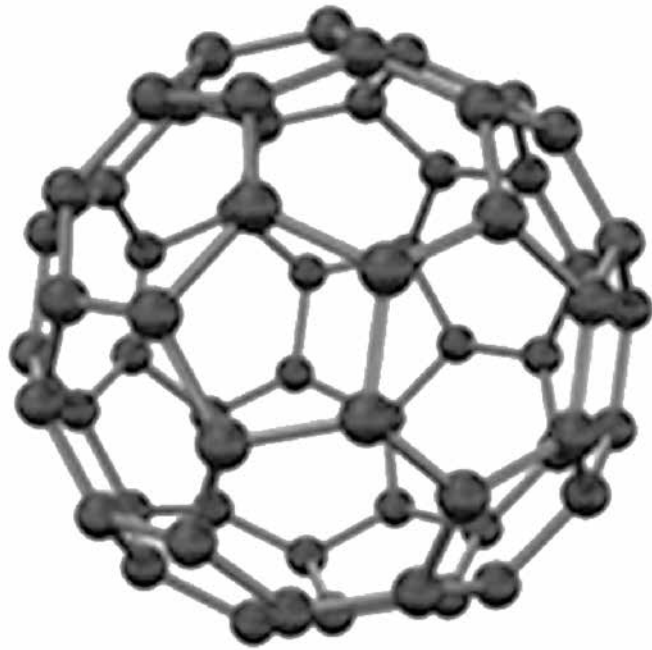
A polymer

[Turn over]



0 1 . 3 **FIGURE 3** shows the structure of C_{60}

FIGURE 3



9

Complete the sentence.

Choose the answer from the list below. [1 mark]

- **diatomic**
- **giant ionic**
- **a fullerene**
- **giant metallic**

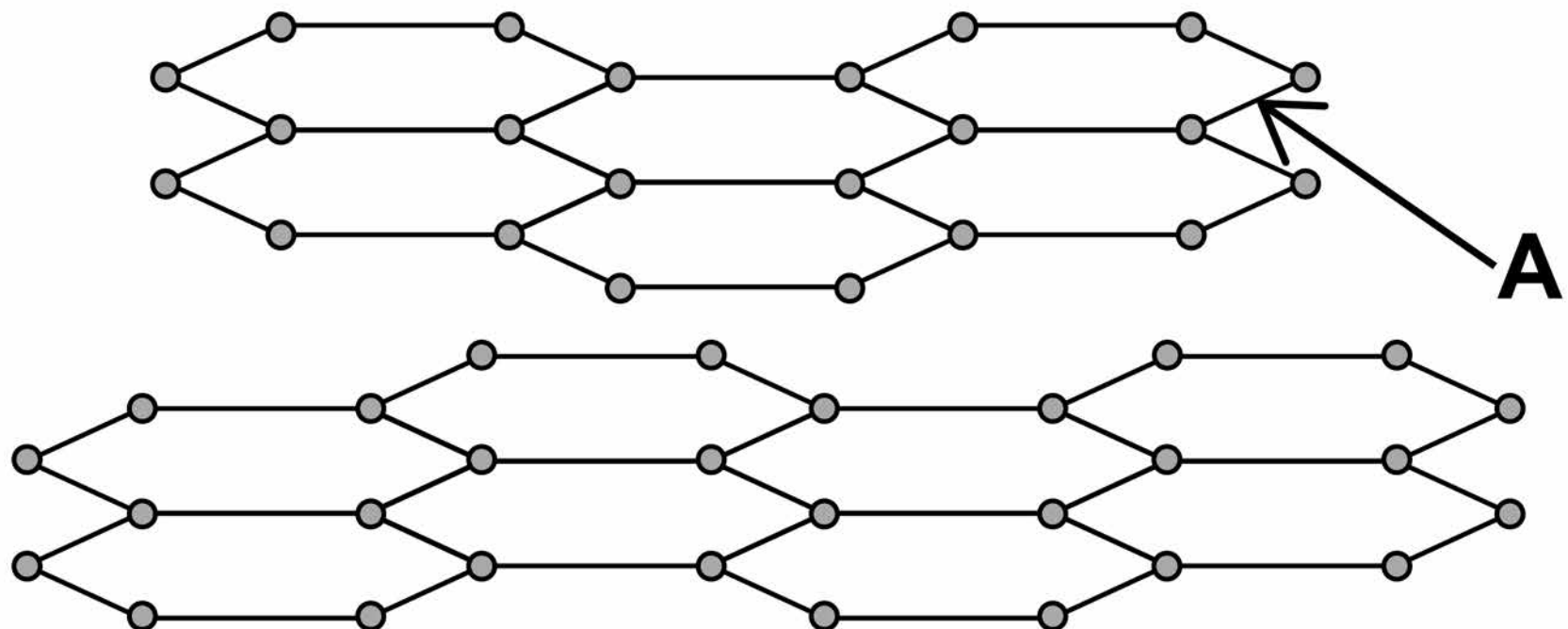
The structure of C₆₀ is

[Turn over]



FIGURE 4 shows the structure of graphite.

FIGURE 4



0 1 . 4 What type of bond is labelled A in FIGURE 4? [1 mark]

Tick ONE box.

covalent

double

ionic

metallic



0 1 . 5 In graphite, each carbon atom forms bonds with other carbon atoms as shown in **FIGURE 4**

How many electrons does ONE carbon atom use to form ONE bond? [1 mark]

Tick ONE box.

1**2****3****4**

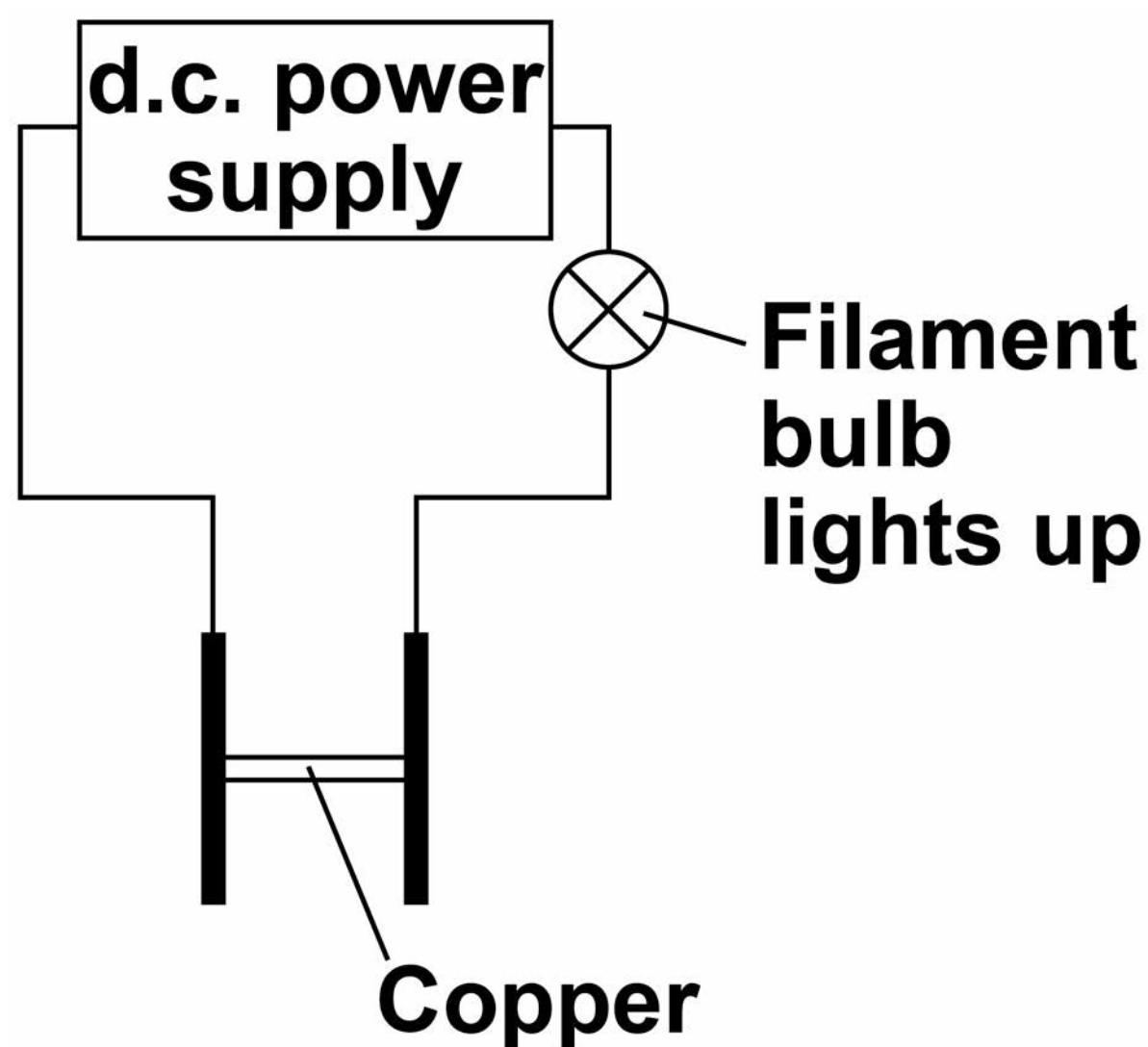
[Turn over]



An electric current is passed through copper.

FIGURE 5 shows the apparatus used.

FIGURE 5



01.6 Complete the sentence.

Choose the answer from the list below. [1 mark]

- gas
- liquid
- solid
- solution

FIGURE 5 shows that copper conducts electricity as a

[Turn over]

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01.7 Complete the sentence.

Choose the answer from the list below. [1 mark]

- atoms
- electrons
- ions
- molecules

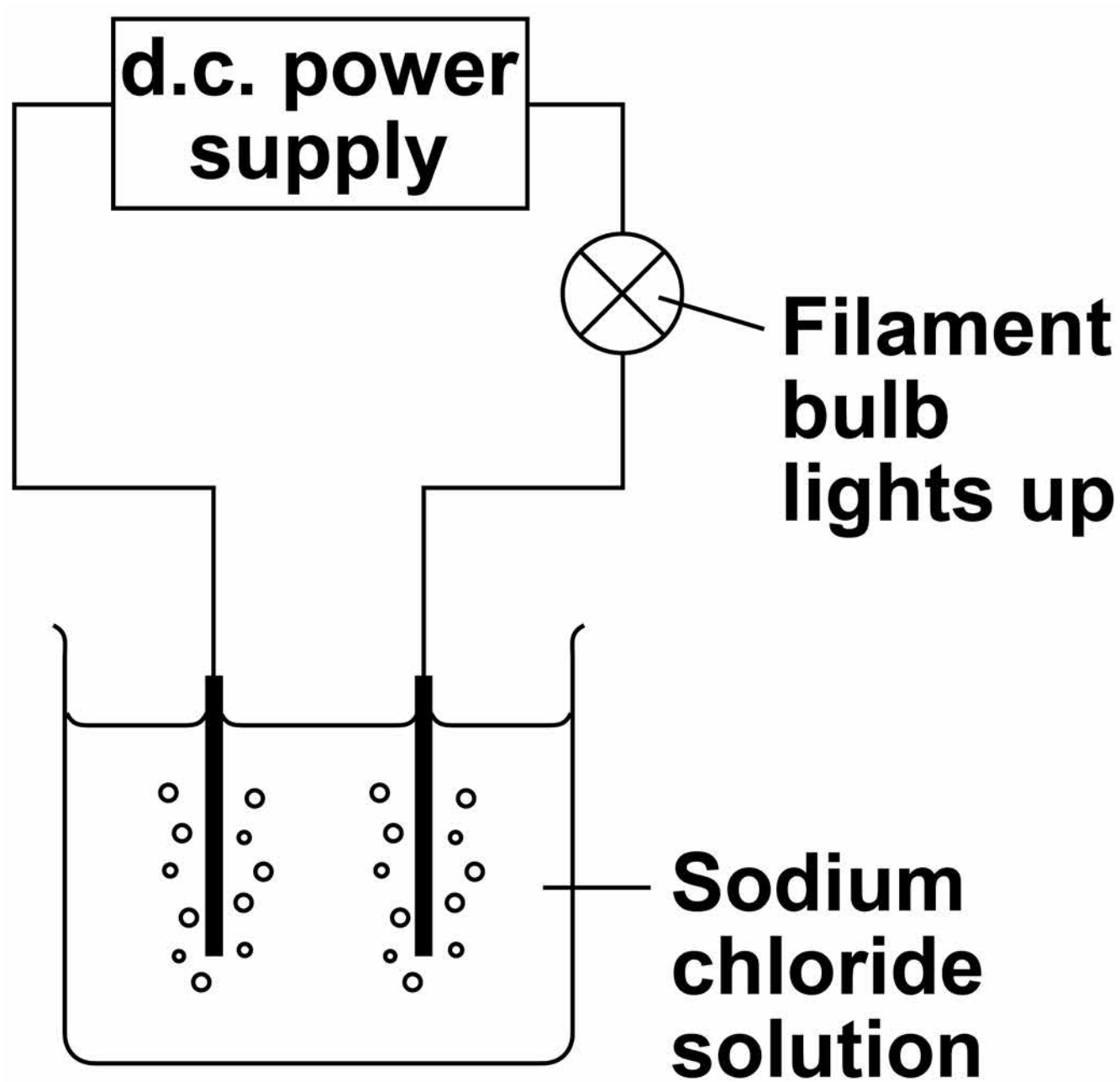
Copper conducts electricity because of the movement of delocalised _____.

[Turn over]



01.8 FIGURE 6 shows the apparatus used to investigate the effect of electricity on sodium chloride solution.

FIGURE 6



17

Complete the sentence.

Choose the answer from the list below. [1 mark]

- **dissolved**
- **gaseous**
- **molten**

FIGURE 6 shows that sodium chloride conducts electricity when
_____.

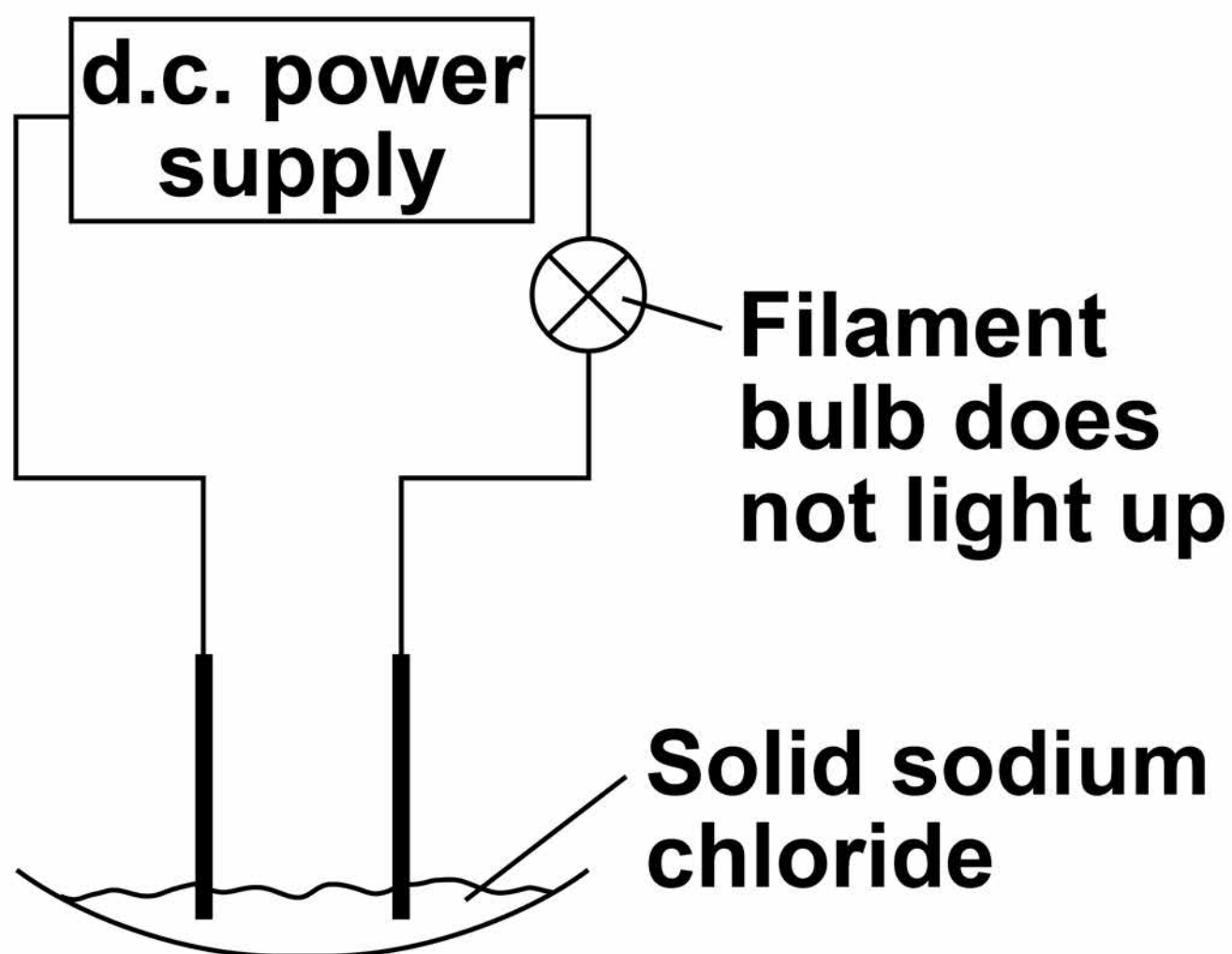
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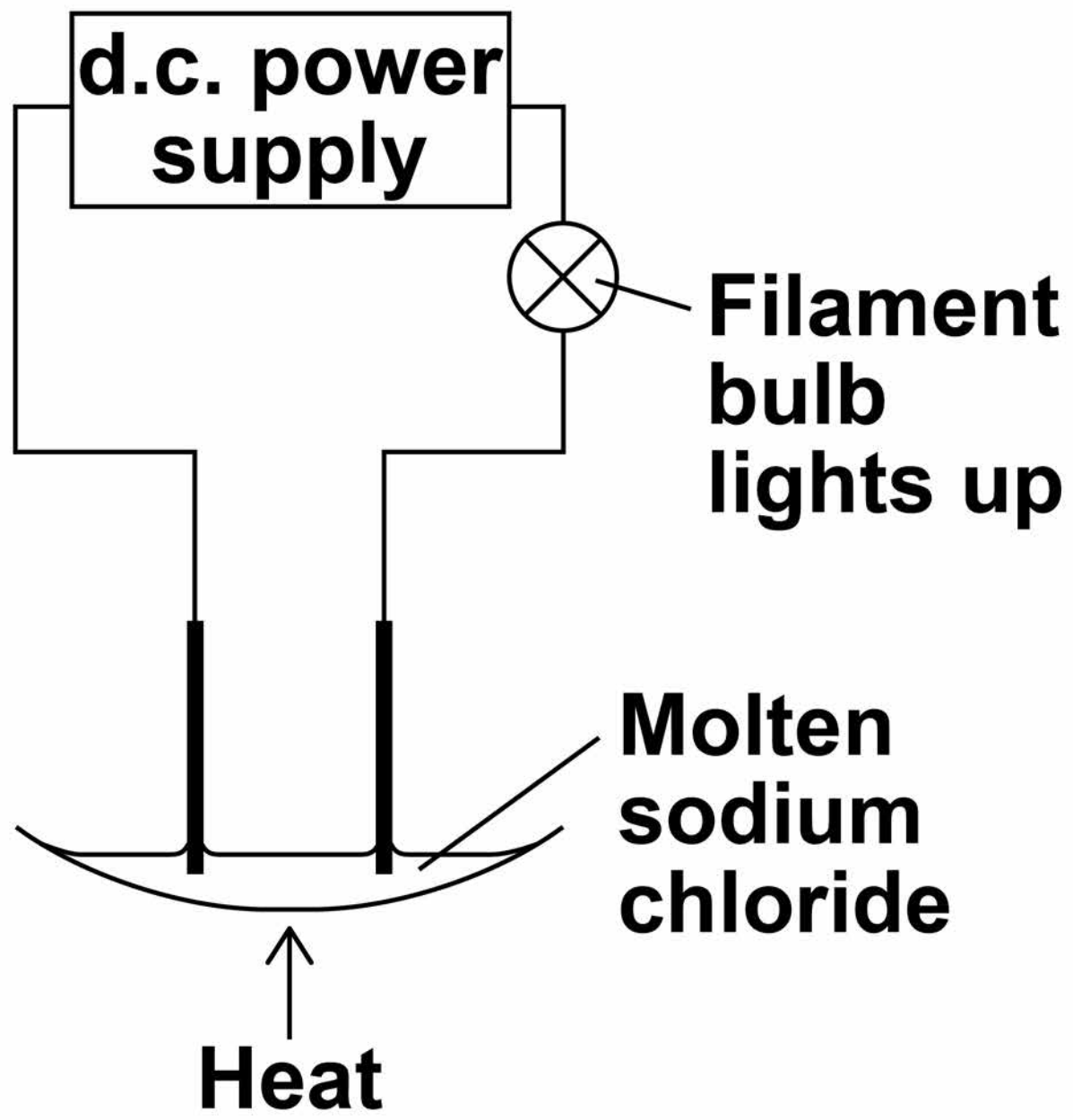


01.9 Sodium chloride is made up of ions.

FIGURE 7, on pages 18 and 19, shows the apparatus used to investigate the effect of electricity on solid sodium chloride and molten sodium chloride.

FIGURE 7





[Turn over]

TABLE 1 shows the results.

TABLE 1

	Solid sodium chloride	Molten sodium chloride
Observation	The filament bulb does not light up	The filament bulb lights up
Deduction	Does not conduct electricity	Does conduct electricity

Draw ONE line from each statement to the correct reason. [2 marks]

STATEMENT**REASON**

Solid sodium chloride does not conduct electricity.

The ions are fixed.

The ions are mobile.

Molten sodium chloride conducts electricity.

The ions are neutral.

The ions are vibrating.

[Turn over]

10



0 2

This question is about the halogens.

0 2 . 1

Which group in the periodic table is known as the halogens?
[1 mark]

Tick **ONE** box.

Group 1

Group 2

Group 7

Group 0



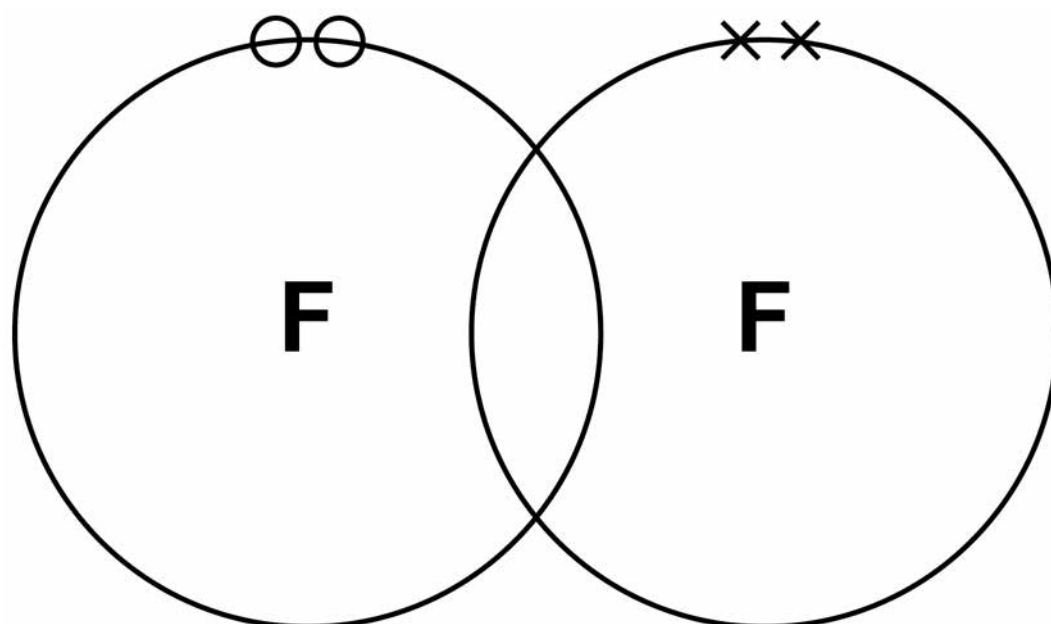
0 2 . 2 A fluorine atom has 7 electrons in the outer shell.

FIGURE 8 shows part of a dot and cross diagram to represent a molecule of fluorine (F_2).

Complete the dot and cross diagram.

You should show only the electrons in the outer shells.
[2 marks]

FIGURE 8



[Turn over]



0 2 . 3 Chlorine reacts with potassium bromide solution.

**Complete the word equation.
[2 marks]**

chlorine + potassium bromide

→

+

0 2 . 4 What type of reaction happens when chlorine reacts with potassium bromide solution?
[1 mark]

Tick ONE box.

decomposition

displacement

neutralisation

precipitation

[Turn over]



0 2 . 5 Complete the sentence.

Choose the answer from the list below. [1 mark]

- an atom
- an electron
- a neutron
- a proton

Chlorine is more reactive than bromine.

**This is because chlorine gains
_____ more easily.**

0 2 . 6 How does the size of a chlorine atom compare with the size of a bromine atom?

Complete the sentence.

Choose the answer from the list below. [1 mark]

- bigger than
- the same size as
- smaller than

**A chlorine atom is _____
_____ a bromine atom.**

[Turn over]



02.7 Give a reason for your answer to question 02.6 [1 mark]

Reason _____

02.8 Fluorine reacts with chlorine to produce ClF_3

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



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[Turn over]



0 2 . 9

Explain why fluorine is a gas at room temperature.

Use the following words in your answer:

energy

forces

molecules

weak

[3 marks]

13

[Turn over]

0 3

This question is about acids and bases.

0 3 . 1

**Which ion is found in all acids?
[1 mark]**

Tick ONE box.

Cl⁻**H⁺****Na⁺****OH⁻**

03.2 Zinc nitrate can be produced by reacting an acid and a metal oxide.

Name the acid and the metal oxide used to produce zinc nitrate. [2 marks]

Acid _____

Metal oxide _____

[Turn over]



03.3 In an equation, zinc nitrate is written as $\text{Zn}(\text{NO}_3)_2(\text{aq})$.

What does (aq) mean? [1 mark]

Tick ONE box.

Dissolved in water

Insoluble

Not all reacted

Reactant

03.4 The pH of a solution is 8

Some hydrochloric acid is added to the solution.

Suggest the pH of the solution after mixing. [1 mark]

pH = _____

[Turn over]

03.5 TABLE 2 shows the solubility of three solids in water at room temperature.

TABLE 2

Solid	The mass of the solid that dissolves in 100 cm³ of water
Phosphorus oxide	50 g
Silicon dioxide	0 g
Sodium hydroxide	100 g

A teacher labelled these three solids A, B and C.

She gave a student the information shown in TABLE 3

TABLE 3

Solid	Observation when added to water	pH of the solid in water
A	colourless solution	14
B	colourless solution	2
C	solid does not dissolve	7

[Turn over]



Describe a method that could be used to identify each of the three solids A, B and C.

You must use an indicator in the method.

**Use information in TABLE 2 and TABLE 3, on pages 36 and 37.
[4 marks]**

[Turn over]

9

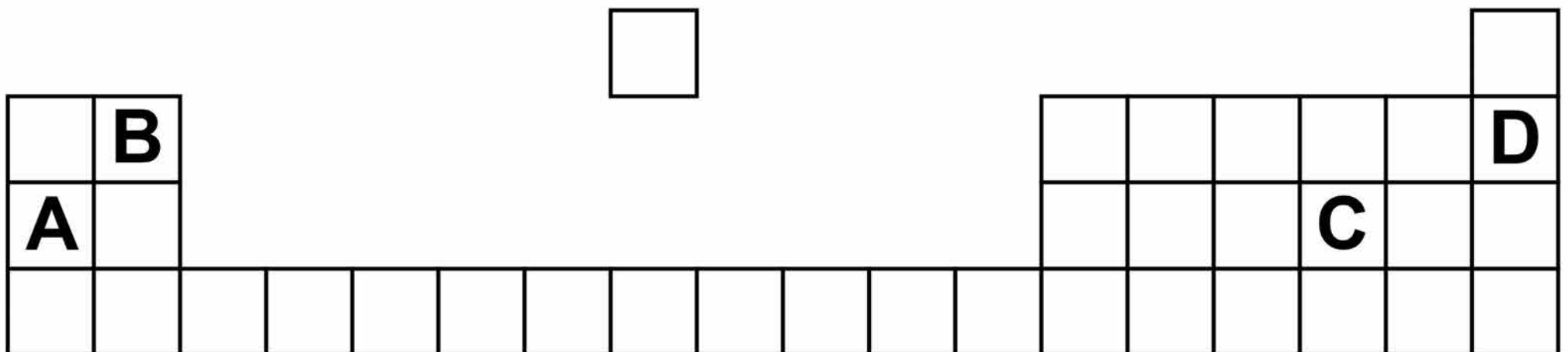
0 4

This question is about the elements in Group 2 of the periodic table.

0 4 . 1

FIGURE 9 shows the positions of four elements, A, B, C and D, in the periodic table.

FIGURE 9



**Which element is in Group 2?
Tick ONE box. [1 mark]**

A

B

C

D

[Turn over]

Group 2 metal carbonates break down when heated to produce a metal oxide and a gas.

metal carbonate → metal oxide + gas

0 4 . 2 Name the two products when calcium carbonate (CaCO_3) is heated. [2 marks]

and

0 4 . 3 What type of reaction happens when a compound breaks down?
[1 mark]

Tick ONE box.

burning

decomposition

neutralisation

reduction

[Turn over]



0 4 . 4 The metal carbonate takes in energy from the surroundings to break down.

**What type of reaction takes in energy from the surroundings?
[1 mark]**

Tick ONE box.

combustion

electrolysis

endothermic

exothermic



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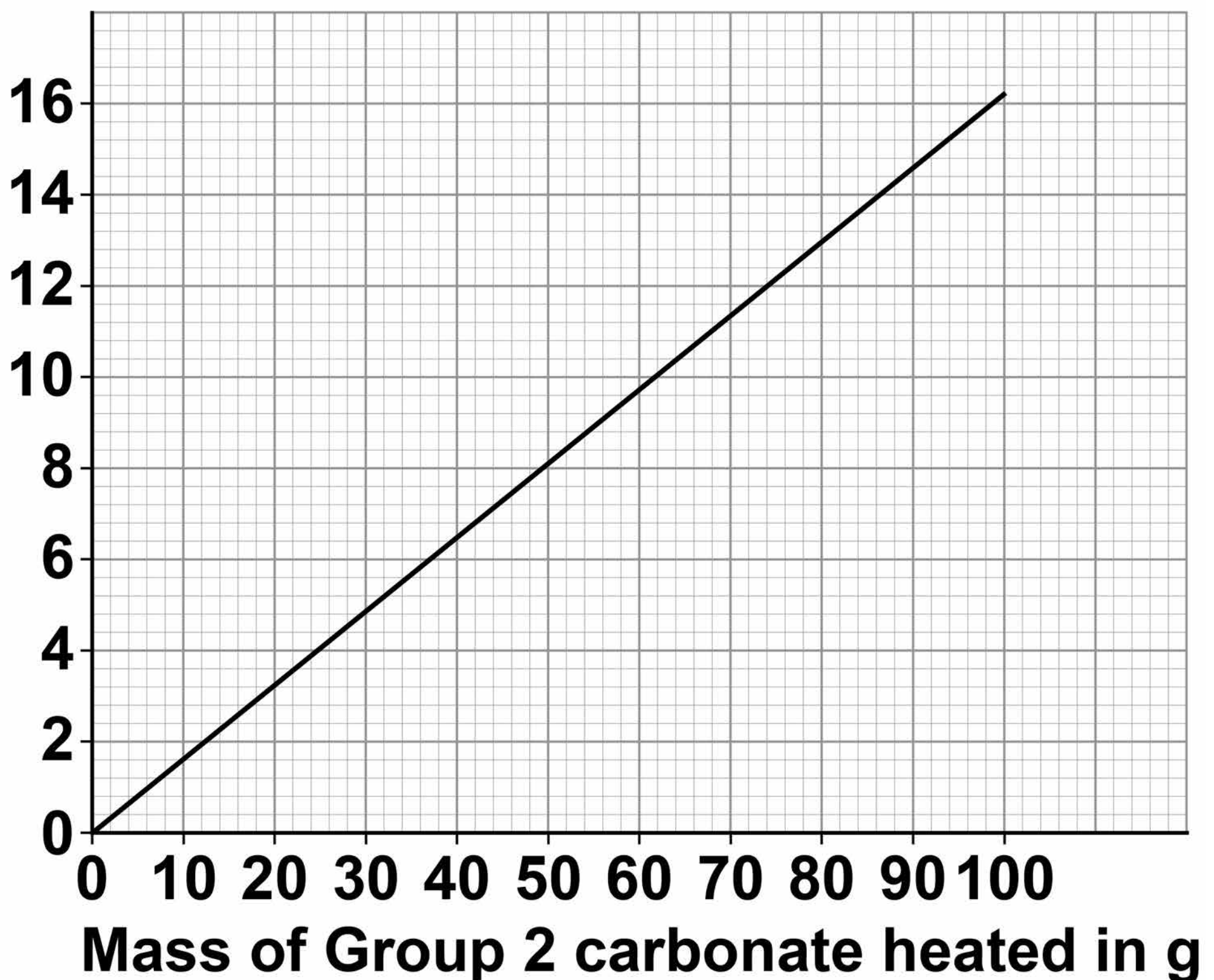
[Turn over]



04.5 FIGURE 10 shows the volume of gas produced when a Group 2 metal carbonate is heated.

FIGURE 10

**Volume
of gas
in dm^3**



47

The student collected 5.2 dm³ of gas.

What mass of the Group 2 metal carbonate is heated? [1 mark]

Mass = _____ g

[Turn over]



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04.6 Calculate the mass of the Group 2 carbonate needed to produce 24 dm³ of gas.

Use your answer from question 04.5 to help you.
[2 marks]

Mass = _____ g

[Turn over]



04.7 A student heated different masses of a Group 2 carbonate. The student measured the volume of gas produced.

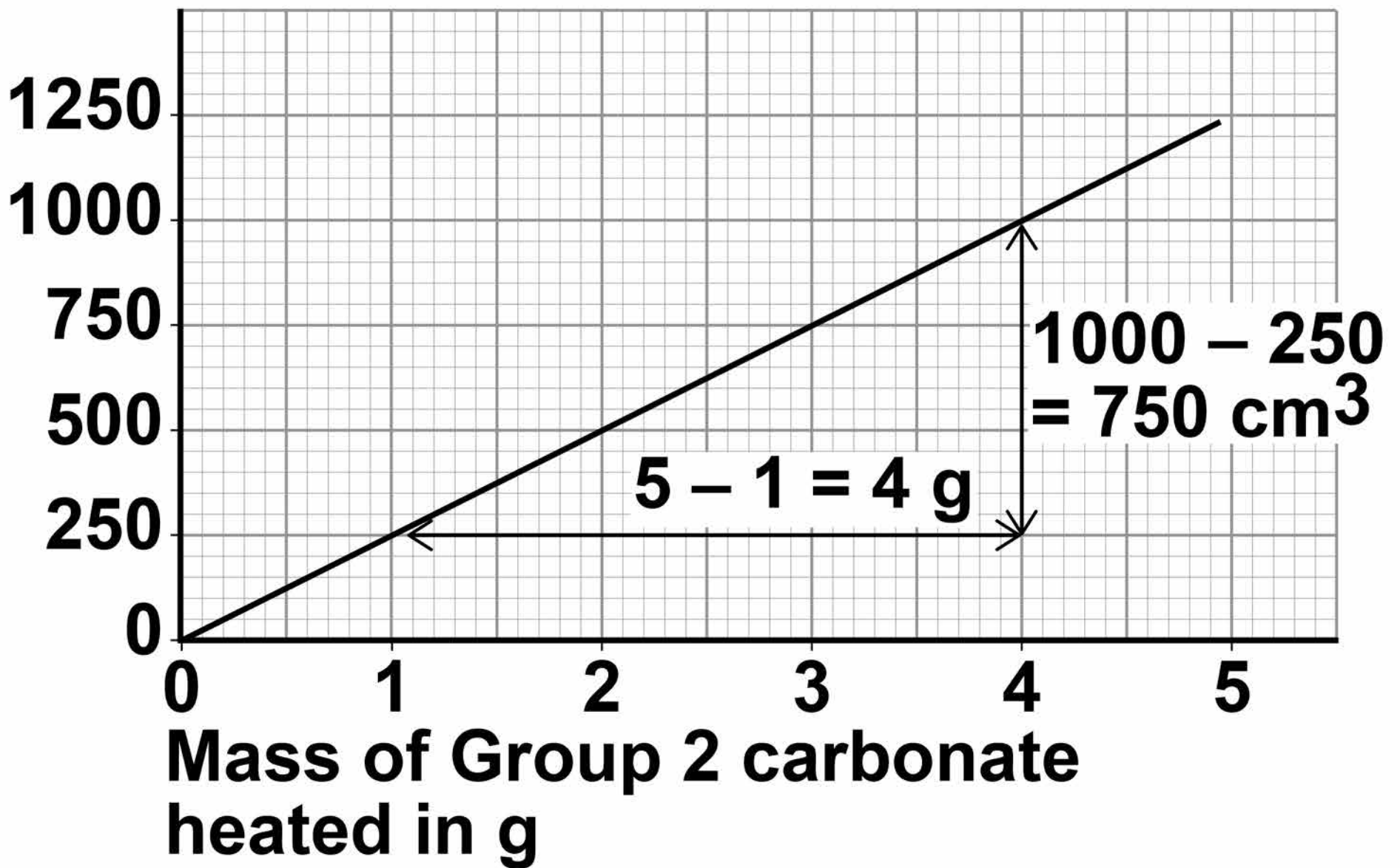
FIGURE 11 shows a graph of the student's results.

The student calculates the gradient of the line in **FIGURE 11**

The student makes **TWO** mistakes.

FIGURE 11

Volume
of gas
in cm^3



[Turn over]



Correct formula for gradient =

$$\frac{\text{Increase in volume of gas}}{\text{Increase in mass of Group 2 metal carbonate heated}}$$

Student's calculation = $\frac{4}{750}$
= 0.00533 cm³ per g

Identify the TWO mistakes the student makes.

Calculate the correct gradient of the line. [4 marks]

Mistake 1 _____

Mistake 2 _____

Calculation _____

Gradient = _____ **cm³ per g**

[Turn over]

0 4 . 8 A student repeated the experiment with a different Group 2 metal carbonate (XCO_3).

The relative formula mass (M_r) of XCO_3 is 84

Relative atomic masses (A_r):
C = 12 O = 16

Calculate the relative atomic mass (A_r) of X.

Name metal X.

Use the periodic table.
[4 marks]



Relative atomic mass (A_r) =

Metal X is

16

[Turn over]

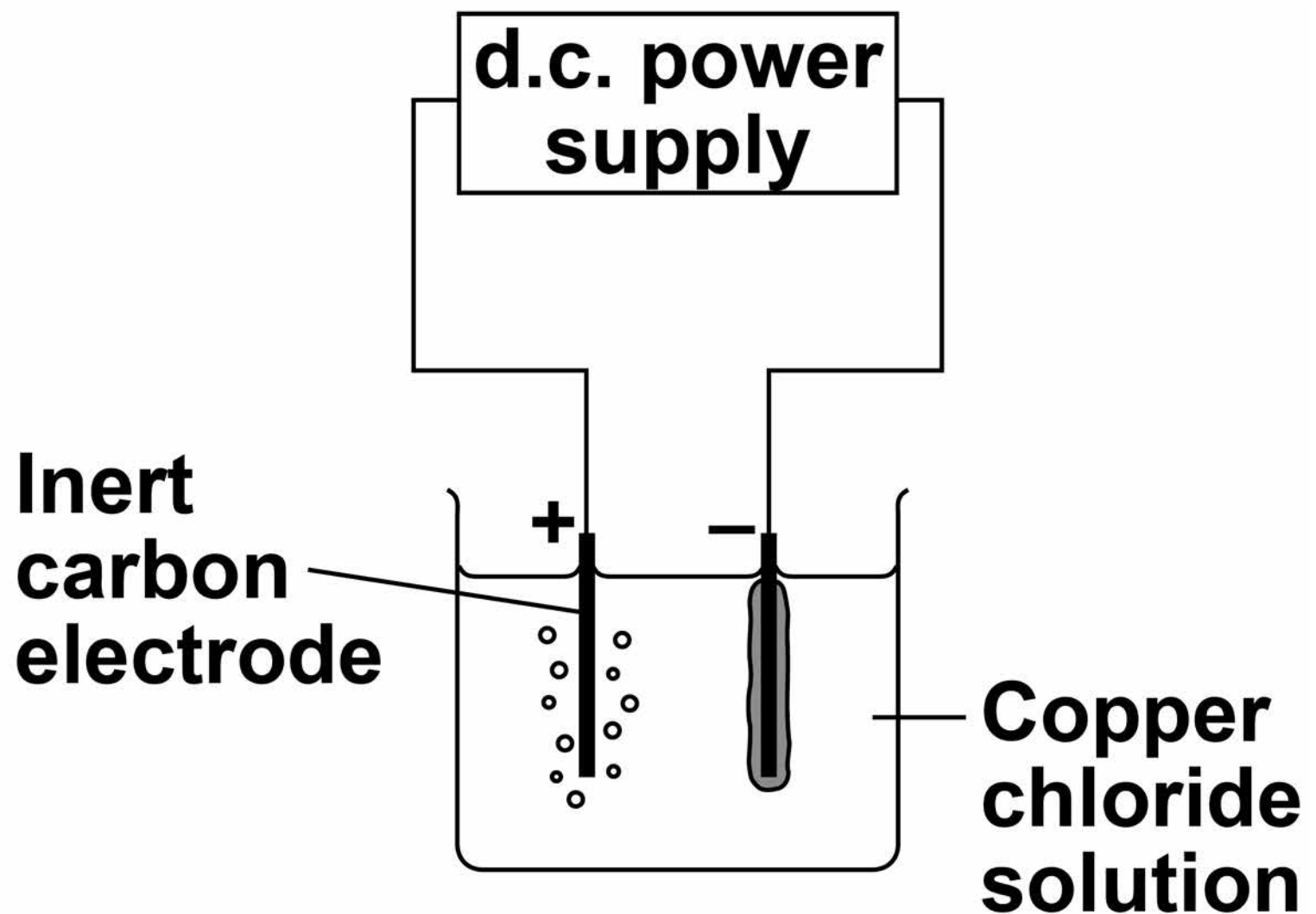
0 5

This question is about electrolysis.

A student investigates the mass of copper produced during electrolysis of copper chloride solution.

FIGURE 12 shows the apparatus.

FIGURE 12



0 5 . 1 Which gas is produced at the positive electrode (anode)?
[1 mark]

Tick ONE box.

carbon dioxide

chlorine

hydrogen

oxygen

[Turn over]



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05.2 Copper is produced at the negative electrode (cathode).

What does this tell you about the reactivity of copper? [1 mark]

Tick ONE box.

Copper is less reactive than hydrogen

Copper is less reactive than oxygen

Copper is more reactive than carbon

Copper is more reactive than chlorine

[Turn over]



TABLE 4 shows the student's results.

TABLE 4

	Total mass of copper produced in mg			
Time in mins	Experiment 1	Experiment 2	Experiment 3	Mean
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	X	3.01	3.06



0 5 . 3 Determine the **MEAN** mass of copper produced after 3 minutes. [1 mark]

Mass = _____ **mg**

[Turn over]



TABLE 4 shows the student's results.

Repeat of TABLE 4

	Total mass of copper produced in mg			
Time in mins	Experiment 1	Experiment 2	Experiment 3	Mean
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	X	3.01	3.06



05.4 Calculate the mass X of copper produced in
EXPERIMENT 2 after 5 minutes.

Use TABLE 4 on page 62 [2 marks]

Mass X = _____ mg

[Turn over]



0 5 . 5 The copper chloride solution used in the investigation contained 300 grams per dm^3 of solid CuCl_2 dissolved in 1 dm^3 of water.

The students used 50 cm^3 of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment. [3 marks]

Mass = _____ g

8

[Turn over]



06

This question is about sodium and chlorine.

FIGURE 13 shows the positions of sodium and chlorine in the periodic table.

FIGURE 13

Na																			

0 6 . 1 State ONE difference and ONE similarity in the electronic structure of sodium and of chlorine. [2 marks]

Difference _____

Similarity _____

[Turn over]

06.2 Sodium atoms react with chlorine atoms to produce sodium chloride (NaCl).

Describe what happens when a sodium atom reacts with a chlorine atom.

Write about electron transfer in your answer. [4 marks]

[Turn over]

0 6 . 3 The reaction between sodium and chlorine is an exothermic reaction.

**Complete the reaction profile for the reaction between sodium and chlorine.
[2 marks]**

FIGURE 14

**Relative
energy**

Reactants

Progress of reaction

8



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[Turn over]



0	7
---	---

A student plans a method to prepare pure crystals of copper sulfate.

The student's method is:

- 1. Add one spatula of calcium carbonate to dilute hydrochloric acid in a beaker.**
- 2. When the fizzing stops, heat the solution with a Bunsen burner until all the liquid is gone.**

The method contains several errors and does not produce copper sulfate crystals.

**Explain the improvements the student should make to the method so that pure crystals of copper sulfate are produced.
[6 marks]**

[Turn over]



6

END OF QUESTIONS



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Question	Mark
1	
2	
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TOTAL	

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