A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

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

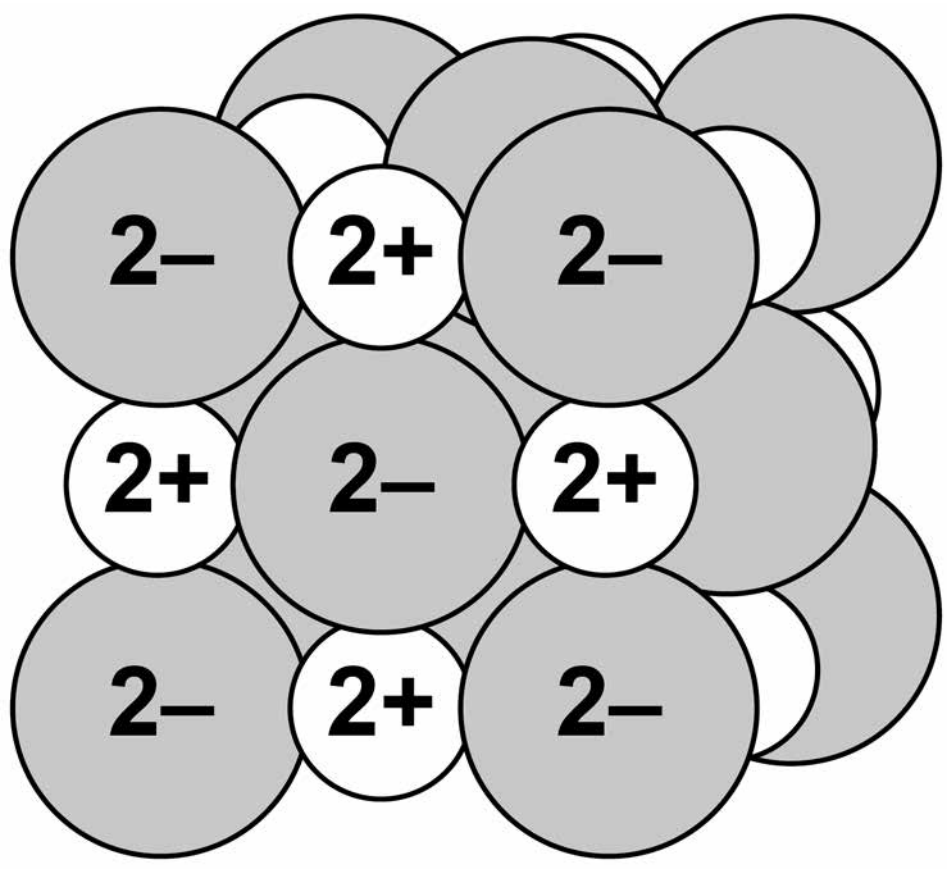
- **The maximum mark for this paper is 70.**
- **The marks for questions are shown in brackets.**
- **You are expected to use a calculator where appropriate.**
- **You are reminded of the need for good English and clear presentation in your answers.**

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



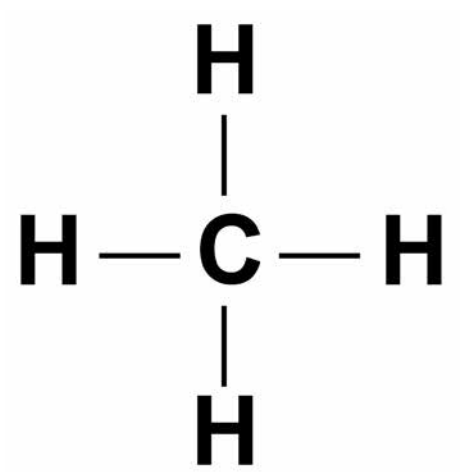
What type of bonding is present in calcium oxide? [1 mark]

Tick ONE box.

- ☐ Covalent
- ☐ Ionic
- ☐ Macromolecular
- ☐ Metallic

0 1 . 2 **FIGURE 2 shows a particle of methane (CH_4).**

FIGURE 2



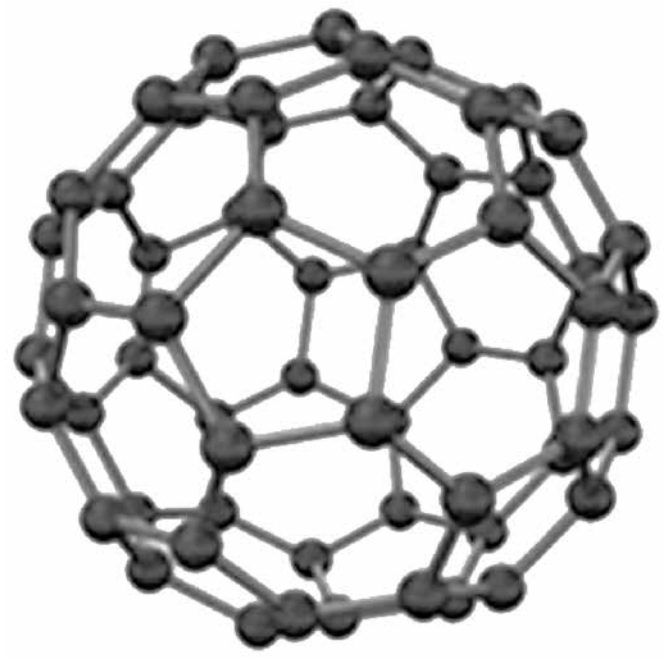
What type of particle is present in FIGURE 2? [1 mark]

Tick ONE box.

- ☐ An ion
- ☐ A lattice
- ☐ A molecule
- ☐ A polymer

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

FIGURE 3



Complete the sentence.

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

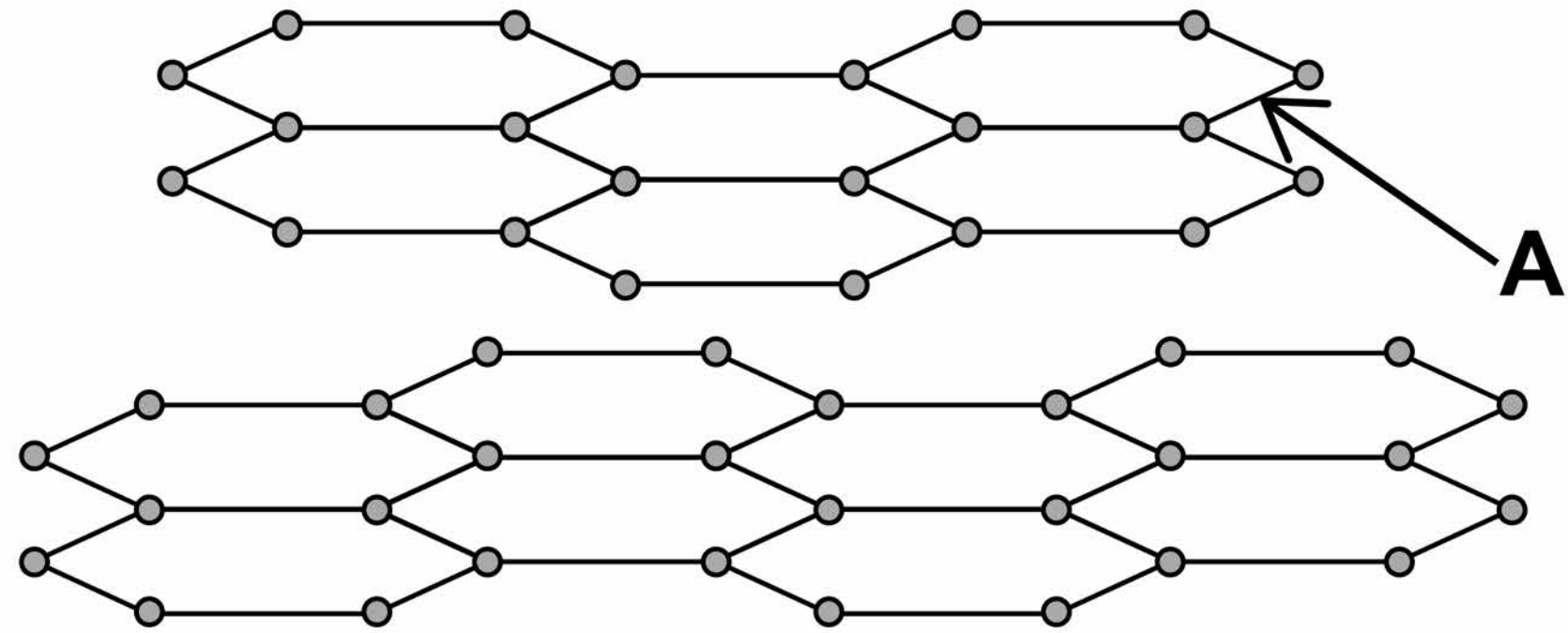
- **diatomic**
- **giant ionic**
- **a fullerene**
- **giant metallic**

The structure of C_{60} is

_____

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.

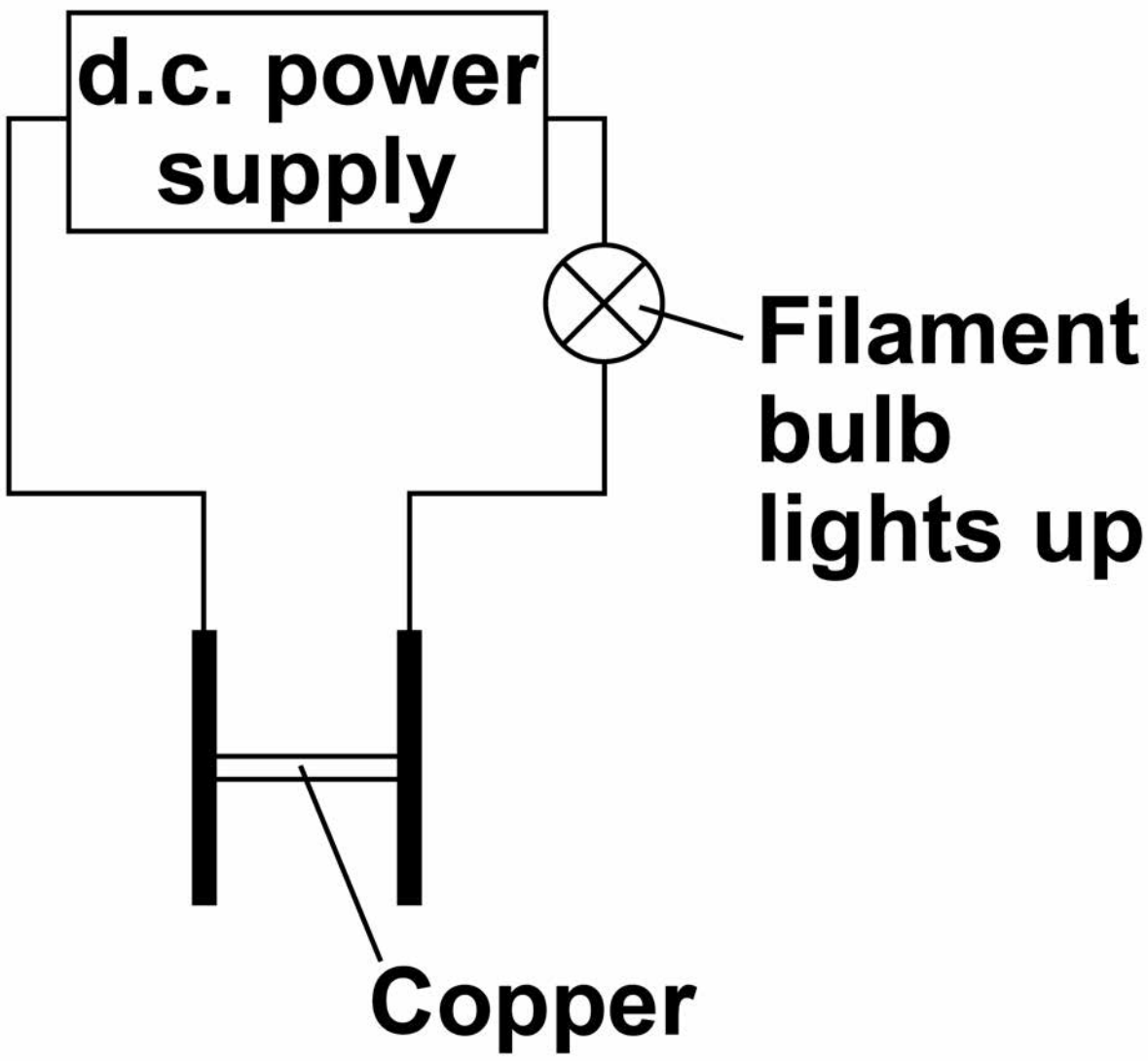
- ☐ **1**
- ☐ **2**
- ☐ **3**
- ☐ **4**

[Turn over]

An electric current is passed through copper.

FIGURE 5 shows the apparatus used.

FIGURE 5



0 1 . 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

_____

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0 1 . 7 **Complete the sentence.**

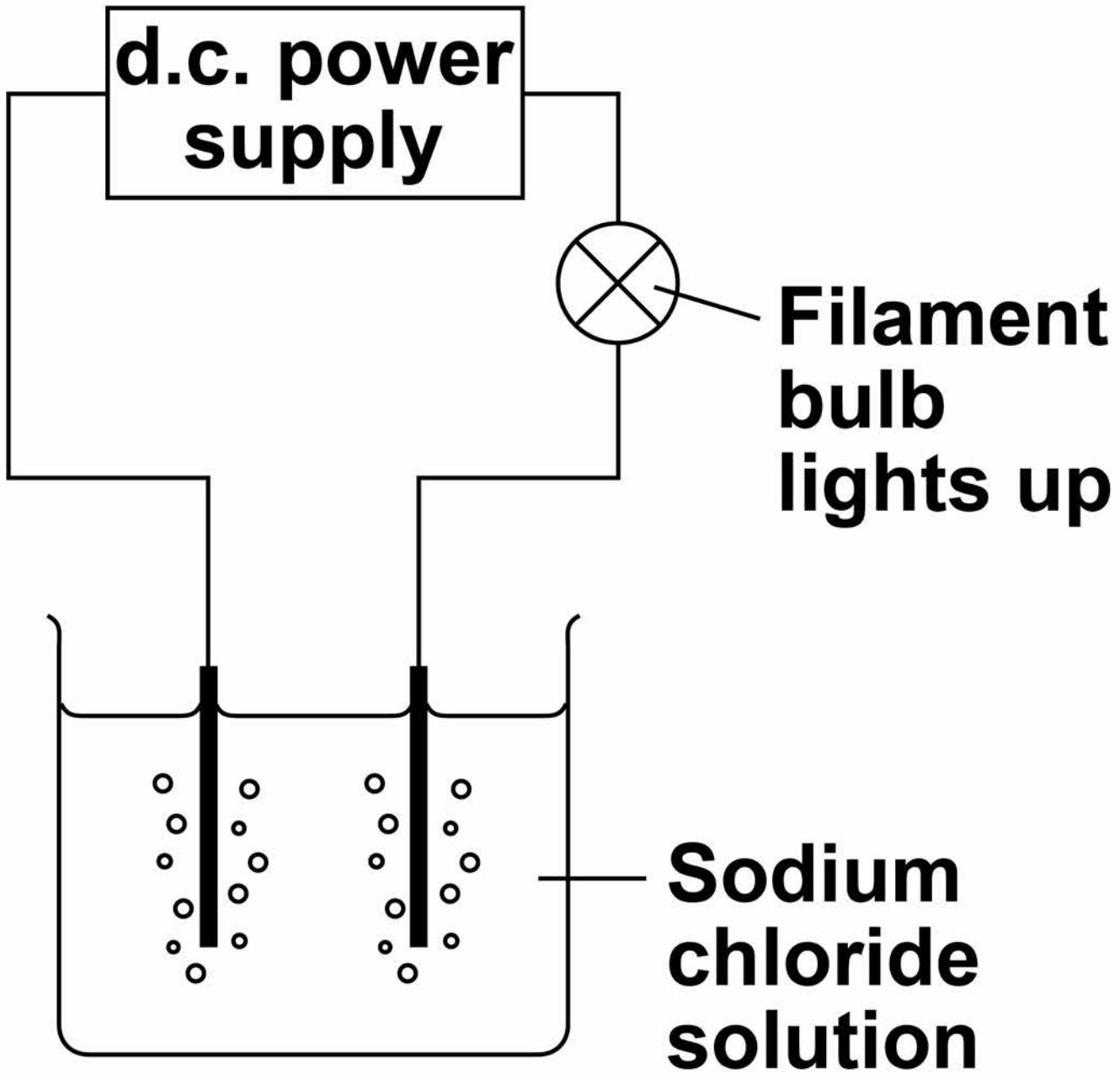
Choose the answer from the list below. [1 mark]

- **atoms**
- **electrons**
- **ions**
- **molecules**

Copper conducts electricity because of the movement of delocalised _____.

0 1 . 8 **FIGURE 6 shows the apparatus used to investigate the effect of electricity on sodium chloride solution.**

FIGURE 6



Complete the sentence.

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

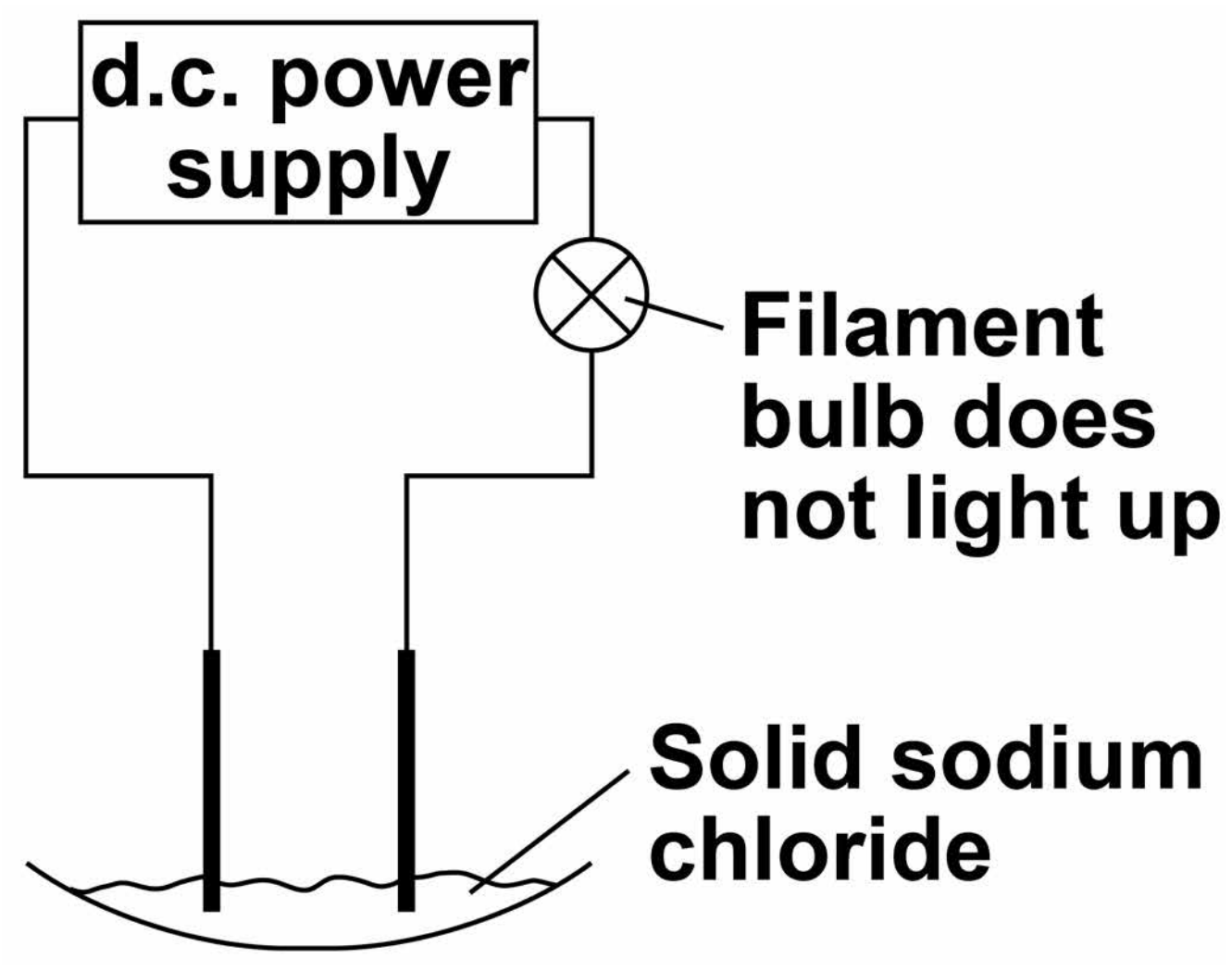
- **dissolved**
- **gaseous**
- **molten**

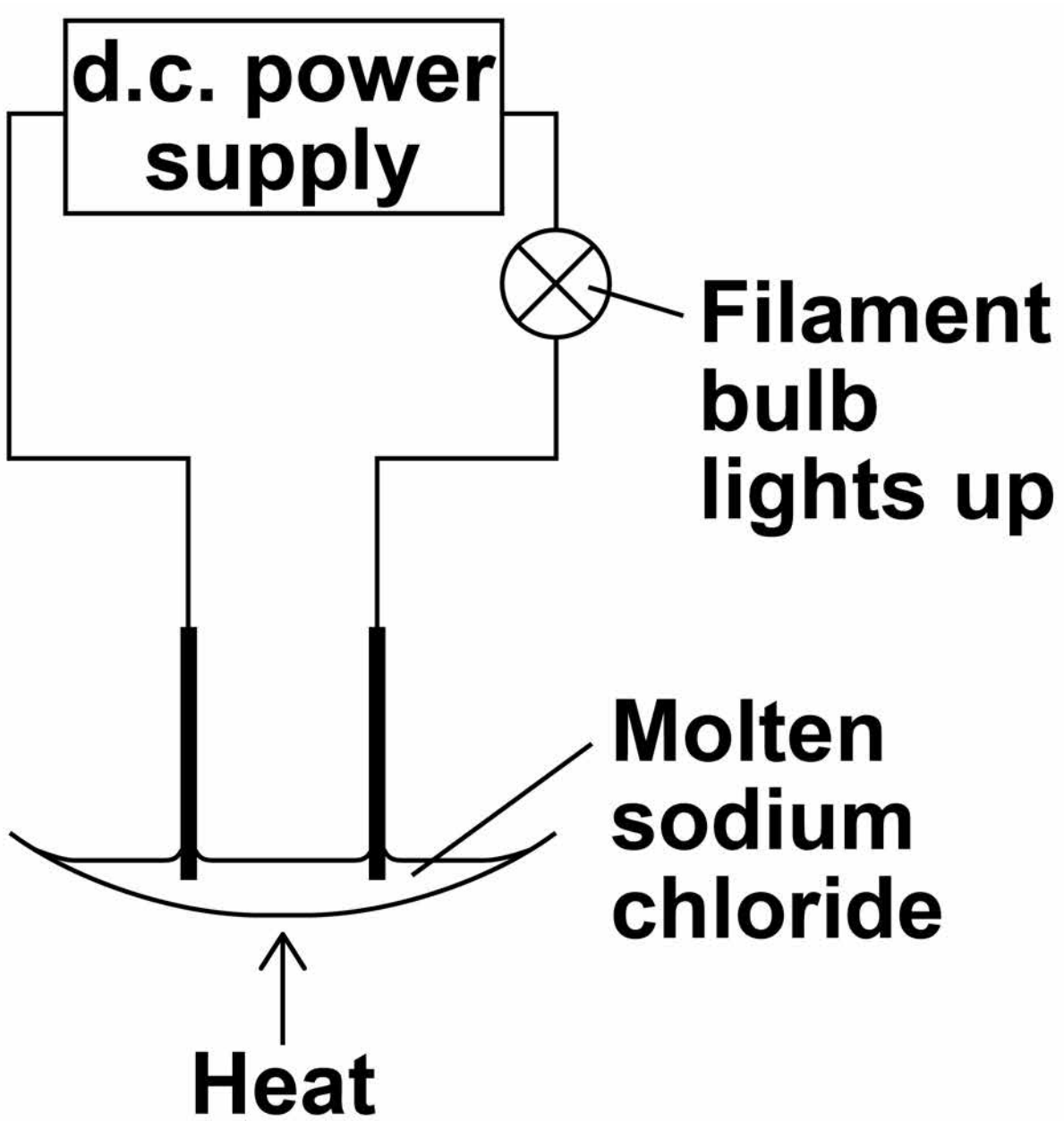
FIGURE 6 shows that sodium chloride conducts electricity when _____.

0 1 . 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.

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.

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**

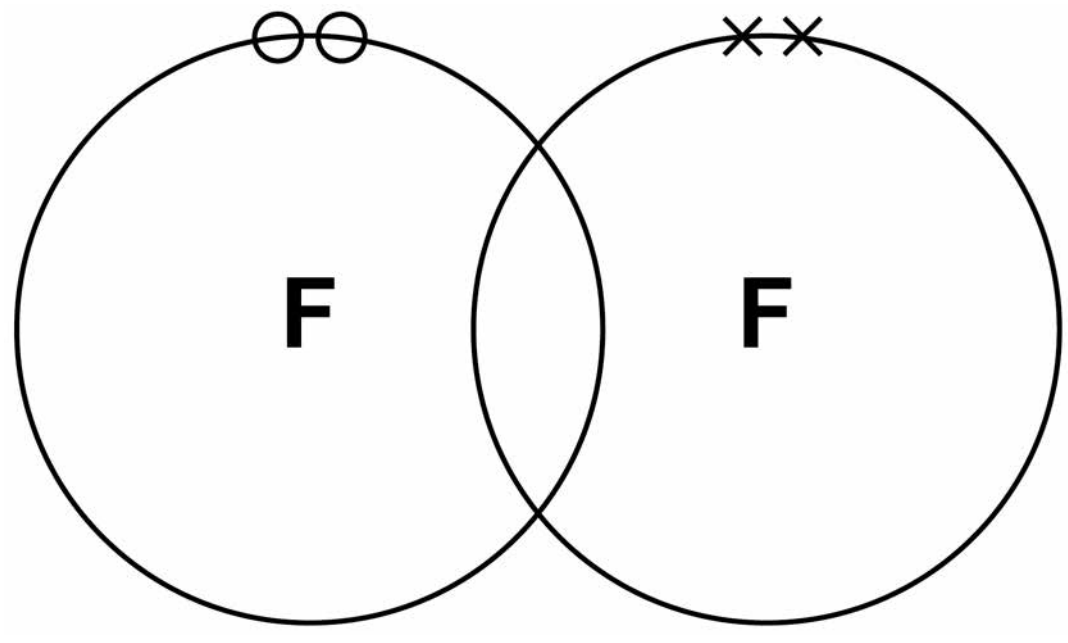
0 2 . 2 **A fluorine atom has 7 electrons in the outer shell.**

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]

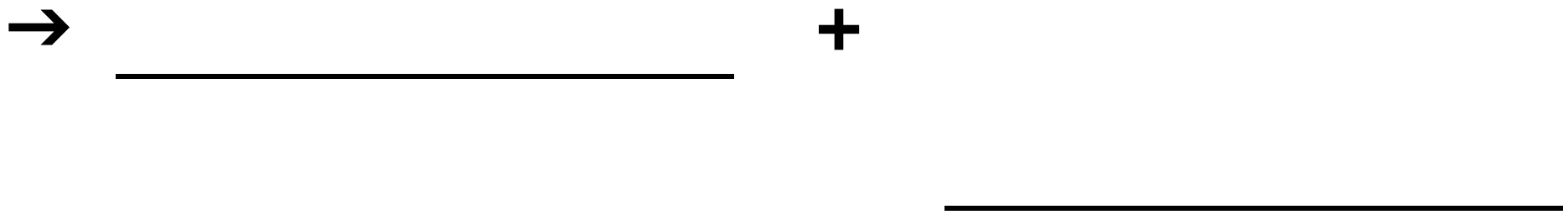
FIGURE 8



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.

0 2 . 7 **Give a reason for your answer to question 02.6 [1 mark]**

Reason _____

_____

_____

0 2 . 8 **Fluorine reacts with chlorine to produce ClF_3**

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

Cl_2 + _____ F_2 → 2 ClF_3

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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]

[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^-

0 3 . 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 _____

_____

0 3 . 3 In an equation, zinc nitrate is written as $Zn(NO_3)_2(aq)$.

What does (aq) mean? [1 mark]

Tick ONE box.

- ☐ Dissolved in water
- ☐ Insoluble
- ☐ Not all reacted
- ☐ Reactant

0 3 . 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]

0 3 . 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 cm^3 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

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]

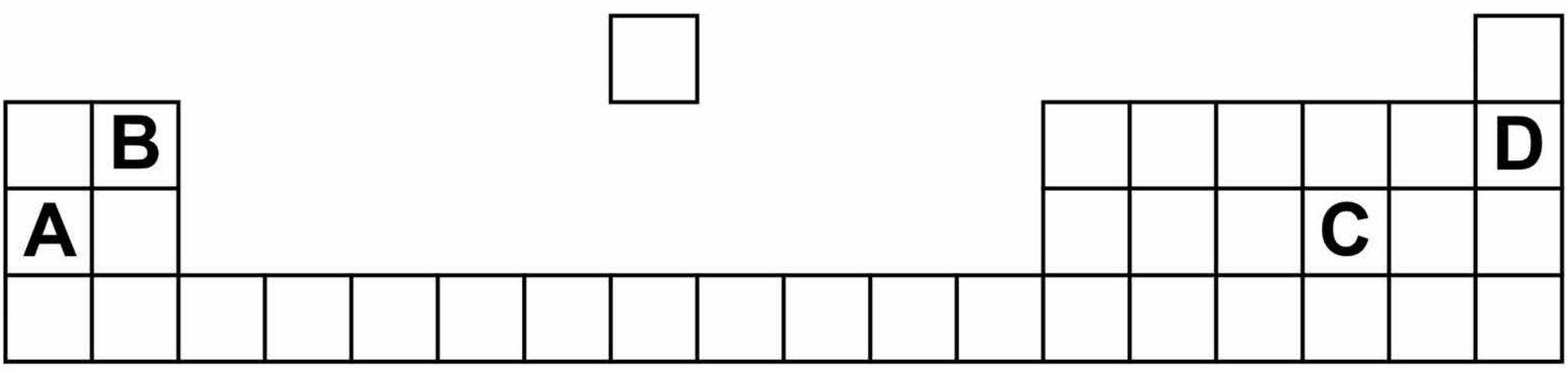
[Turn over]

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

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**

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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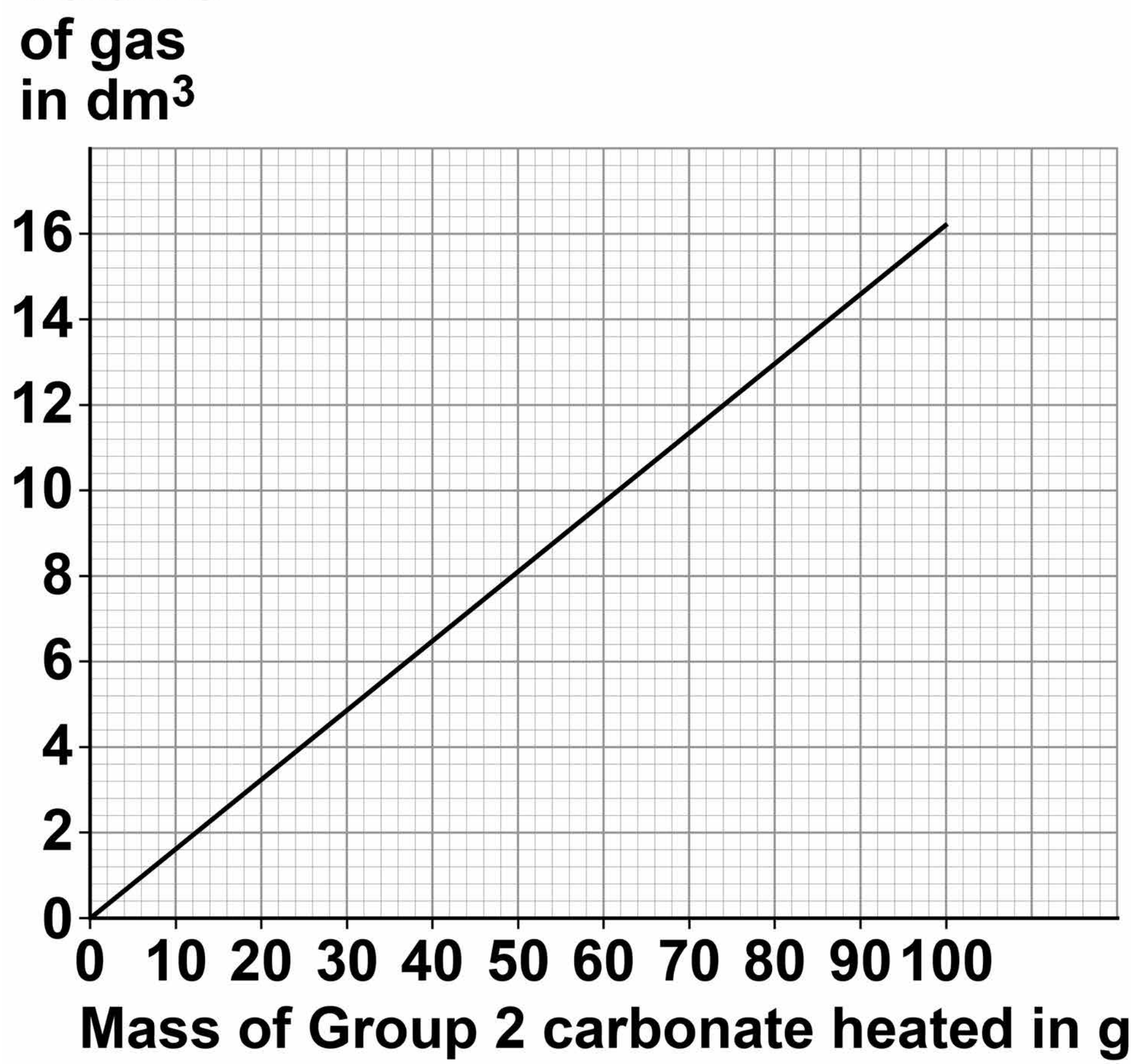
[Turn over]

0 4 . 5 **FIGURE 10 shows the volume of gas produced when a Group 2 metal carbonate is heated.**

FIGURE 10



The student collected 5.2 dm^3 of gas.

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

Mass = _____ g

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0 4 . 6 **Calculate the mass of the Group 2 carbonate needed to produce 24 dm^3 of gas.**

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

Mass = _____ g

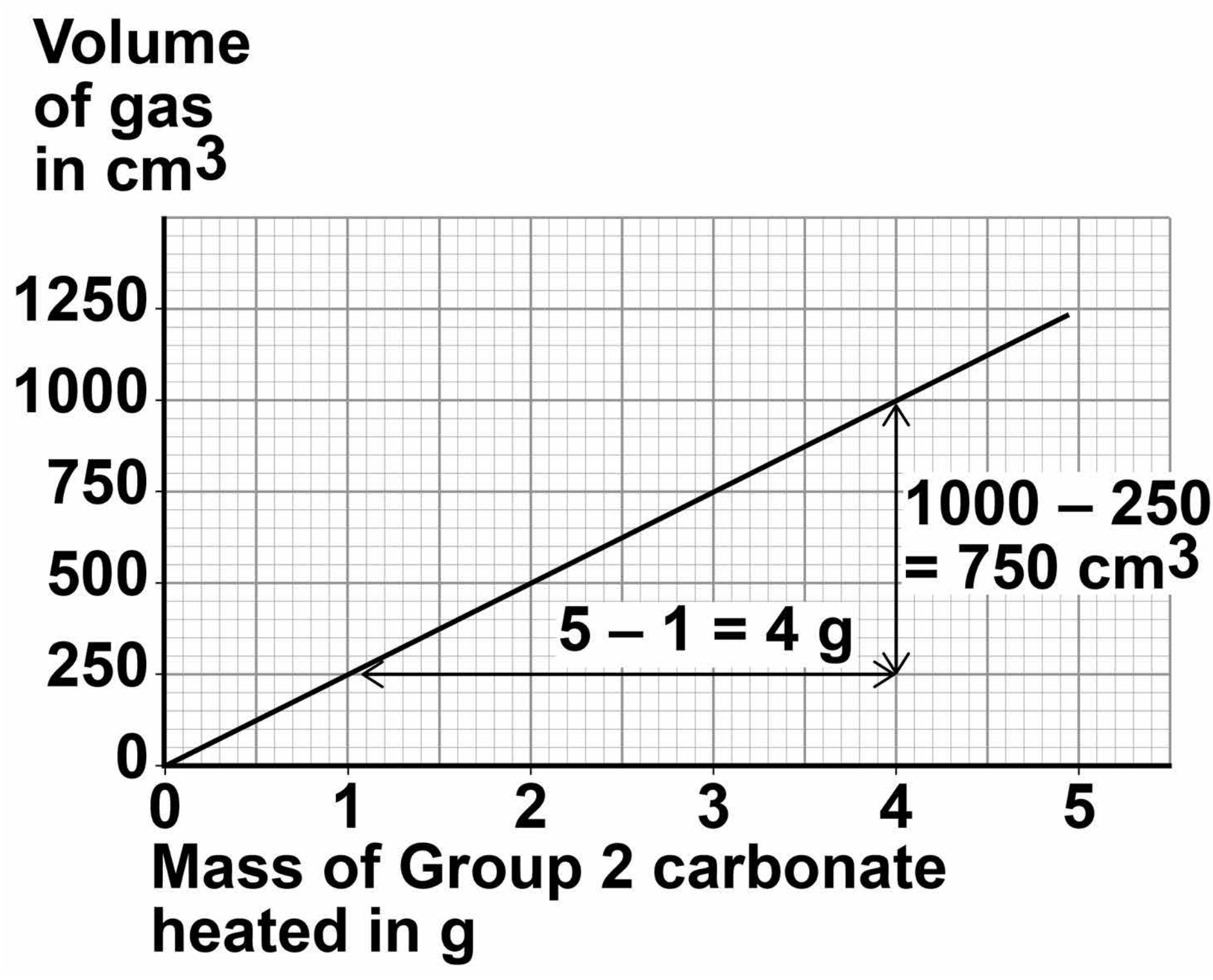
0 4 . 7 **A student heated different masses of a Group 2 carbonate. The student measured the volume of gas produced.**

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



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 cm^3 per g

Identify the TWO mistakes the student makes.

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

Mistake 1

Mistake 2

Calculation _____

_____

_____

Gradient = _____ **cm^3 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

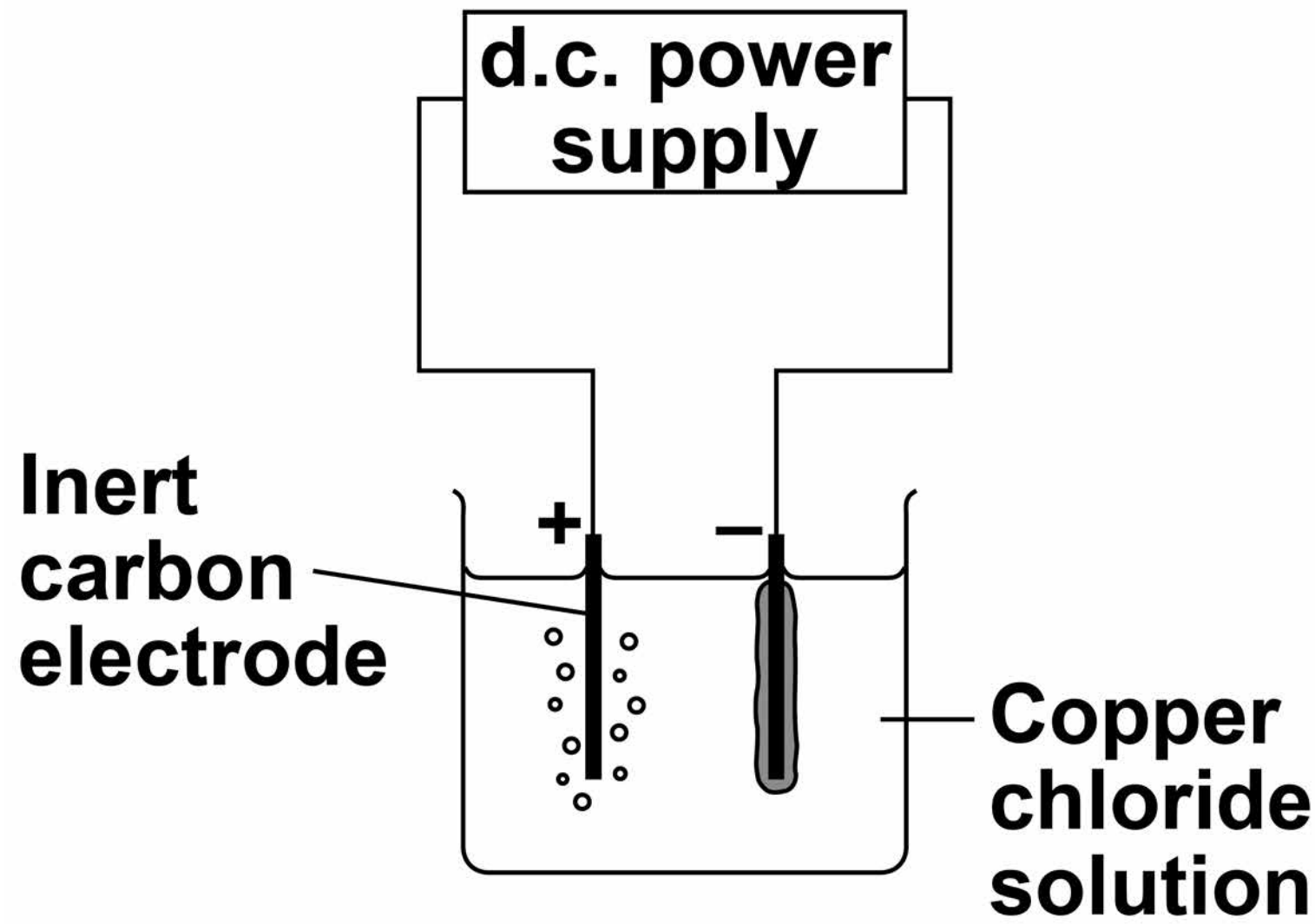
[Turn over]

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

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0 5 . 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

0 5 . 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]

_____

_____

_____

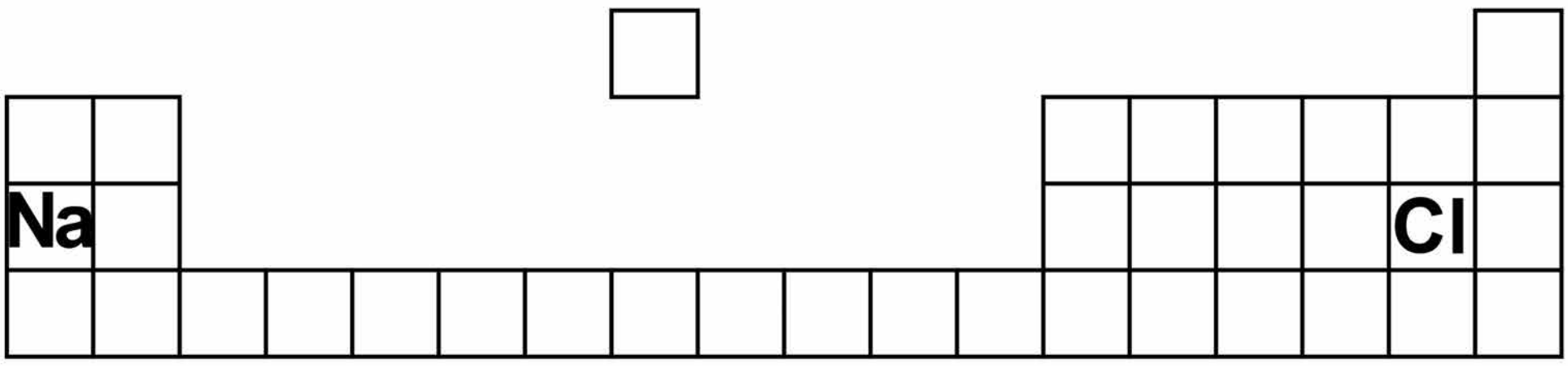
Mass = _____ **g**

[Turn over]

0 6 **This question is about sodium and chlorine.**

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

FIGURE 13



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

Difference _____

_____

Similarity _____

_____

_____

0 6 . 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]

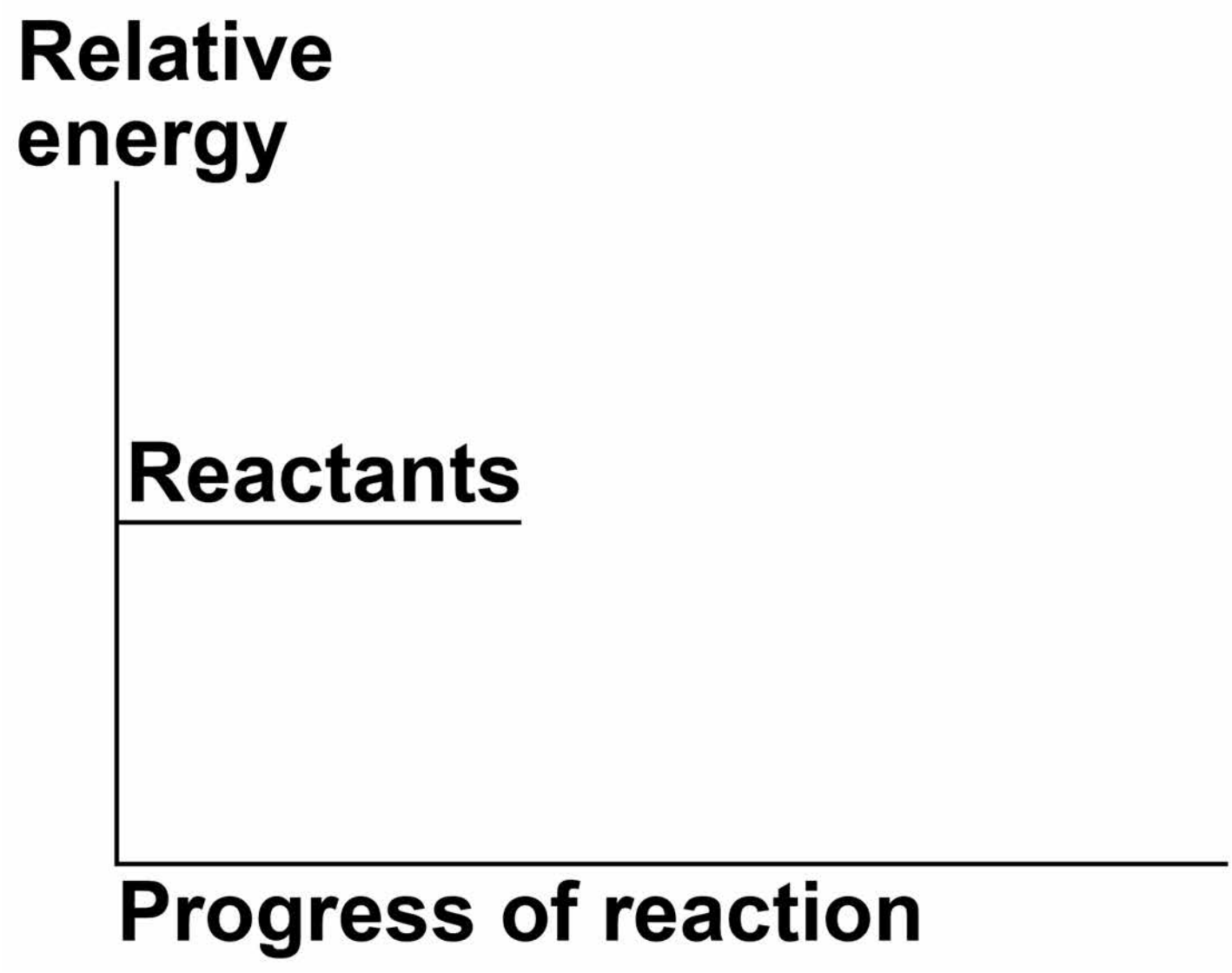
[Turn over]

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



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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]

END OF QUESTIONS

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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	