



Please write clearly in block capitals.

Centre number

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# GCSE COMBINED SCIENCE: TRILOGY

# F

Foundation Tier  
Chemistry Paper 1F

Thursday 17 May 2018

Morning

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.
- Fill in the boxes at the top of this page.
- 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.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
<b>TOTAL</b>	



J U N 1 8 8 4 6 4 C 1 F 0 1

IB/M/Jun18/E10

**8464/C/1F**

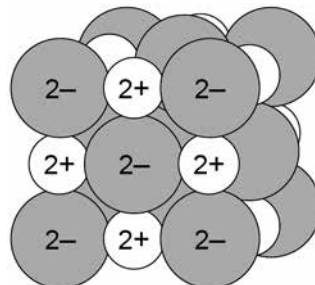
0 1

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

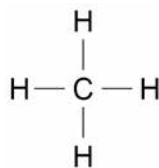
Macromolecular

Metallic



**0 1 . 2** Figure 2 shows a particle of methane (CH<sub>4</sub>).

Figure 2



What type of particle is present in **Figure 2**?

[1 mark]

Tick **one** box.

An ion

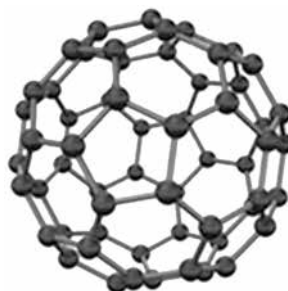
A lattice

A molecule

A polymer

**0 1 . 3** Figure 3 shows the structure of C<sub>60</sub>

Figure 3



Complete the sentence.

Choose the answer from the box.

[1 mark]

**diatomic      giant ionic      a fullerene      giant metallic**

The structure of C<sub>60</sub> is \_\_\_\_\_.

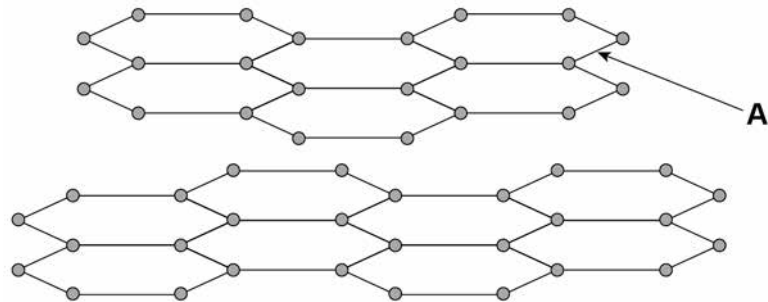
Turn over ►



Figure 4 shows the structure of graphite.

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outside the  
box

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

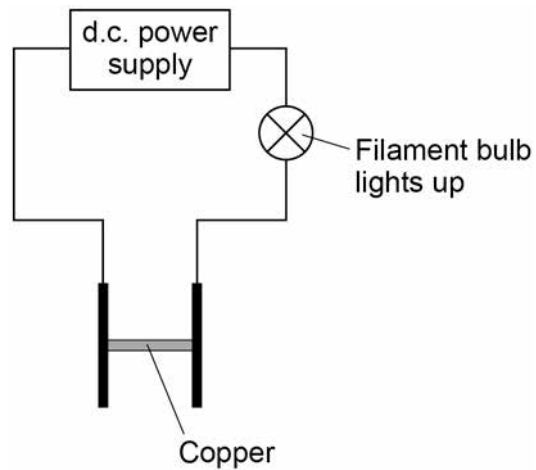
4



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 box.

[1 mark]

gas	liquid	solid	solution
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Figure 5 shows that copper conducts electricity as a \_\_\_\_\_.

0 1 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

atoms	electrons	ions	molecules
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Copper conducts electricity because of the movement of delocalised \_\_\_\_\_.

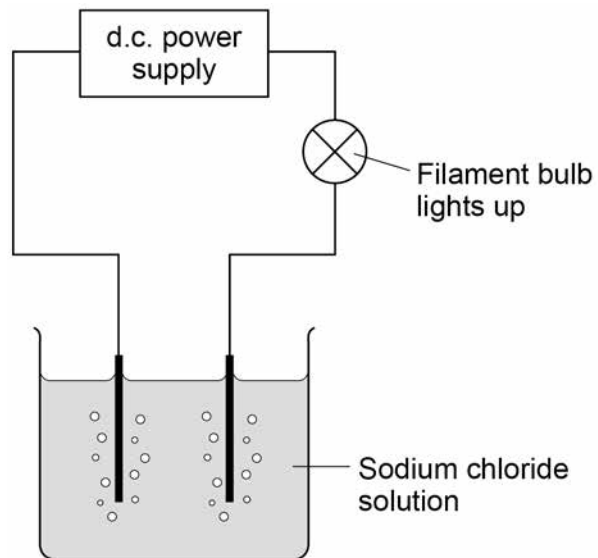
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0 1 . 8

**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 box.

[1 mark]

dissolved      gaseous      molten

**Figure 6** shows that sodium chloride conducts electricity when \_\_\_\_\_.

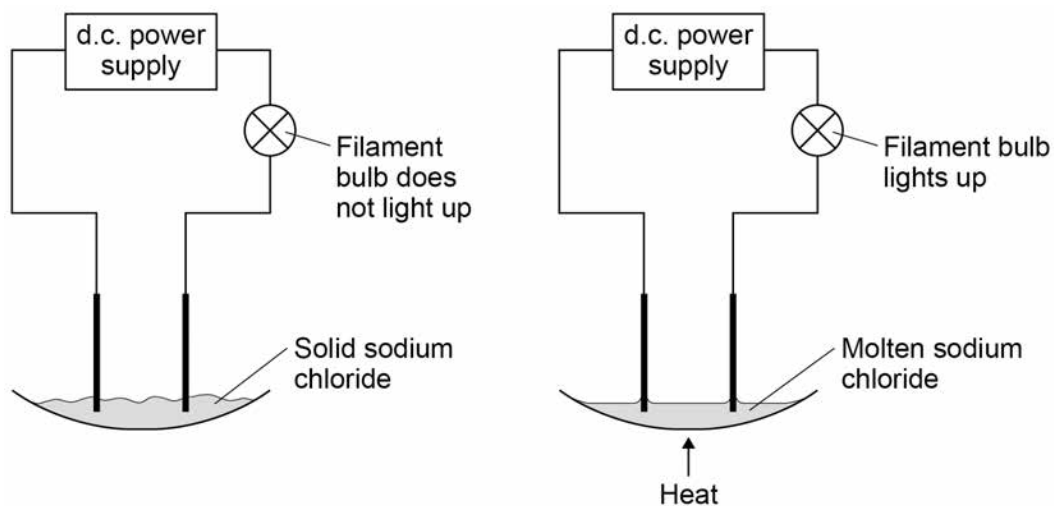


0 1 . 9

Sodium chloride is made up of ions.

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box

**Figure 7** shows the apparatus used to investigate the effect of electricity on solid sodium chloride and molten sodium chloride.

**Figure 7**

**Table 1** shows the results.

**Table 1**

	<b>Solid sodium chloride</b>	<b>Molten sodium chloride</b>
<b>Observation</b>	The filament bulb does not light up	The filament bulb lights up
<b>Deduction</b>	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 ►



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

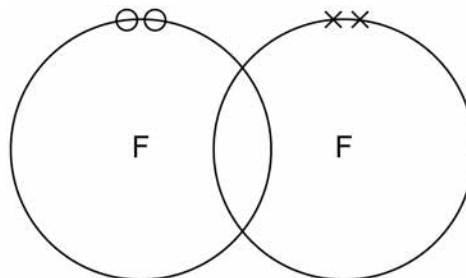
A fluorine atom has 7 electrons in the outer shell.

**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]





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

Tick **one** box.

decomposition

displacement

neutralisation

precipitation

**0 2 . 5** Complete the sentence.

Choose the answer from the box.

**[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 box.

**[1 mark]**

**bigger than      the same size as      smaller than**

A chlorine atom is \_\_\_\_\_ a bromine atom.

**Turn over ►**



**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  $\text{ClF}_3$

Balance the chemical equation for the reaction.

**[1 mark]**



**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]**

\_\_\_\_\_

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**0 3** This question is about acids and bases.

**0 3**. **1** Which ion is found in all acids?

[1 mark]

Tick **one** box.

$\text{Cl}^-$

$\text{H}^+$

$\text{Na}^+$

$\text{OH}^-$

**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  $\text{Zn}(\text{NO}_3)_2(\text{aq})$ .

What does (aq) mean?

[1 mark]

Tick **one** box.

Dissolved in water

Insoluble

Not all reacted

Reactant

**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.

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**Table 2**

Solid	The mass of the solid that dissolves in 100 cm <sup>3</sup> 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
<b>A</b>	colourless solution	14
<b>B</b>	colourless solution	2
<b>C</b>	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**

[4 marks]

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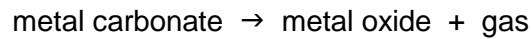
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Group 2 metal carbonates break down when heated to produce a metal oxide and a gas.



**0 4 . 2** Name the two products when calcium carbonate ( $\text{CaCO}_3$ ) 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

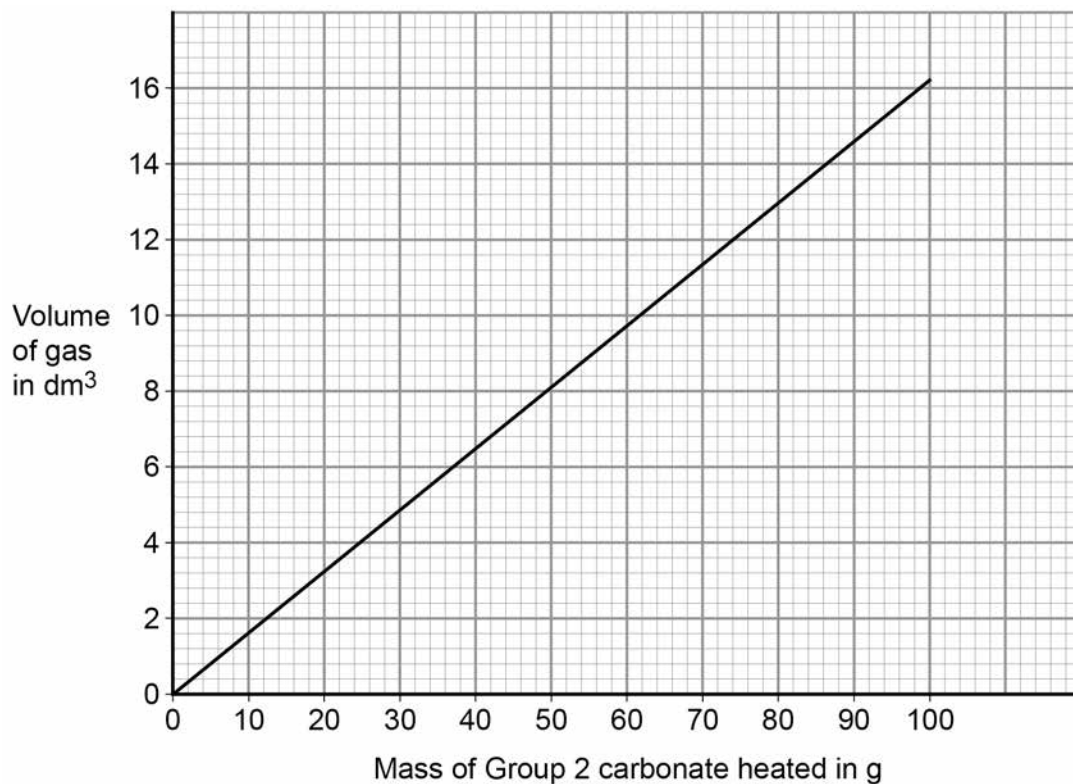
endothermic

exothermic



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<sup>3</sup> of gas.

What mass of the Group 2 metal carbonate is heated?

**[1 mark]**

Mass = \_\_\_\_\_ g

0 4 . 6

Calculate the mass of the Group 2 carbonate needed to produce 24 dm<sup>3</sup> of gas.

Use your answer from question **04.5** to help you.

**[2 marks]**


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Mass = \_\_\_\_\_ g

**Turn over ►**

0 4 . 7

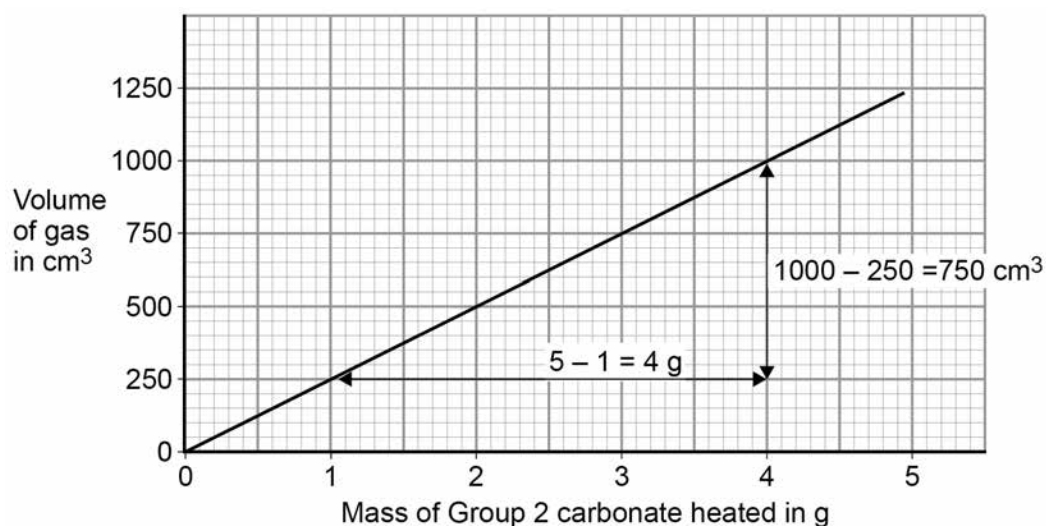
A student heated different masses of a Group 2 carbonate. The student measured the volume of gas produced.

**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 =  $\frac{4}{750} = 0.00533 \text{ cm}^3 \text{ per g}$

Identify the **two** mistakes the student makes.

Calculate the correct gradient of the line.

**[4 marks]**

Mistake 1 \_\_\_\_\_

\_\_\_\_\_

Mistake 2 \_\_\_\_\_

\_\_\_\_\_

Calculation \_\_\_\_\_

\_\_\_\_\_

Gradient = \_\_\_\_\_  $\text{cm}^3 \text{ per g}$





0	4	.	8
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A student repeated the experiment with a different Group 2 metal carbonate ( $\text{XCO}_3$ ).

The relative formula mass ( $M_r$ ) of  $\text{XCO}_3$  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]

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Relative atomic mass ( $A_r$ ) = \_\_\_\_\_

Metal X is \_\_\_\_\_

_____
16

**Turn over for the next question**

**Turn over ►**

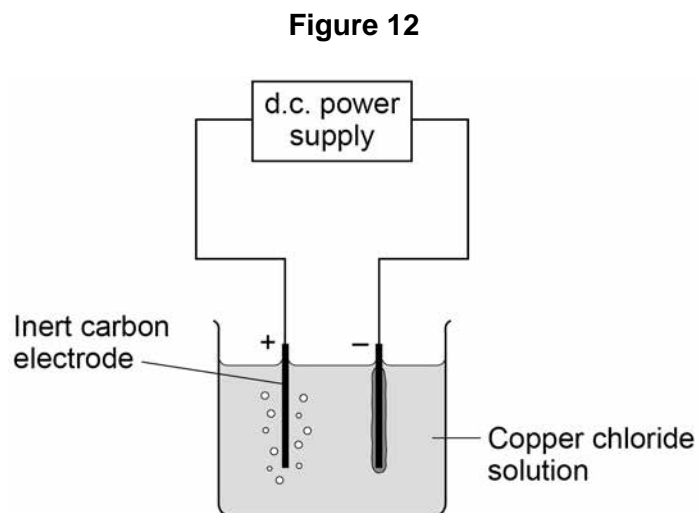


**0 5**

This question is about electrolysis.

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

**Figure 12** shows the apparatus.

**0 5 . 1**

Which gas is produced at the positive electrode (anode)?

**[1 mark]**

Tick **one** box.

carbon dioxide

chlorine

hydrogen

oxygen



**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

**Table 4** shows the student's results.

**Table 4**

Time in mins	Total mass of copper produced in mg			
	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]

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Mass = \_\_\_\_\_ mg

**Question 5 continues on the next page**

**Turn over ►**



**0 5 . 4** Calculate the mass **X** of copper produced in **Experiment 2** after 5 minutes.

Use **Table 4** on page 19

**[2 marks]**

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Mass **X** = \_\_\_\_\_ mg

**0 5 . 5** The copper chloride solution used in the investigation contained 300 grams per  $\text{dm}^3$  of solid  $\text{CuCl}_2$  dissolved in  $1 \text{ dm}^3$  of water.

The students used  $50 \text{ cm}^3$  of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment.

**[3 marks]**

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Mass = \_\_\_\_\_ g

8



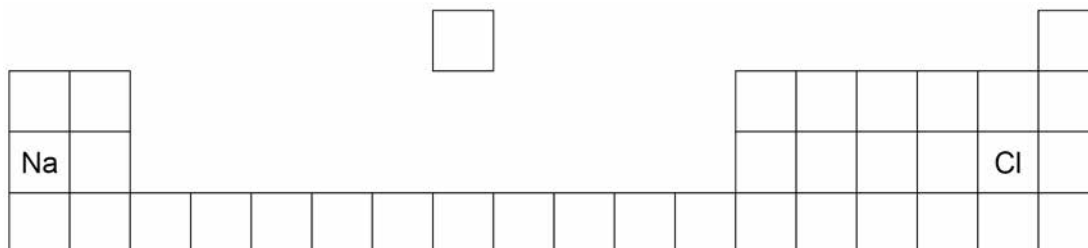
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0 6

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

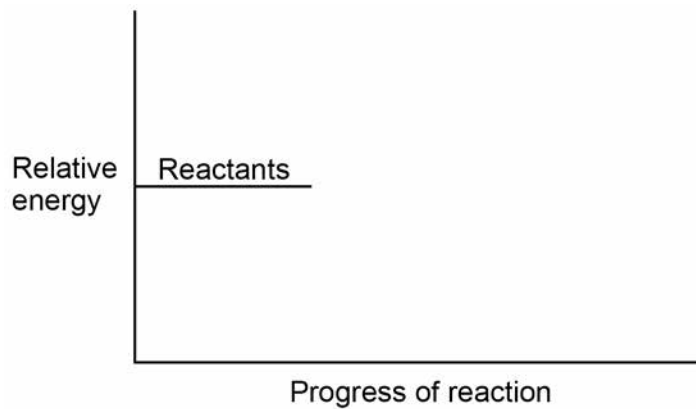
The reaction between sodium and chlorine is an exothermic reaction.

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Complete the reaction profile for the reaction between sodium and chlorine.

[2 marks]

Figure 14



8



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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]

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END OF QUESTIONS

6



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