

**AQA** **Surname** \_\_\_\_\_**Other Names** \_\_\_\_\_**Centre Number** \_\_\_\_\_**Candidate Number** \_\_\_\_\_**Candidate Signature** \_\_\_\_\_**GCSE****COMBINED SCIENCE: SYNERGY****Foundation Tier****Paper 3 Physical sciences****F****8465/3F****Monday 11 June 2018****Morning****Time allowed: 1 hour 45 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)**
- **the Physics Equations Sheet (enclosed).**

## **INSTRUCTIONS**

- **Use black ink or black ball-point pen.**
- **Answer ALL questions in the spaces provided. Do not write on blank pages.**
- **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 100.**
- **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
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**A teacher extracted copper from copper oxide.**

**This is the method used.**

- 1. Mix 1.30 g of zinc and 1.59 g of copper oxide.**
- 2. Heat the mixture strongly.**
- 3. When the mixture starts to glow, stop heating.**
- 4. Let the glow spread through the mixture.**
- 5. Leave the mixture to cool.**

5

**0 1 . 1** This reaction is exothermic.

**Which part of the method shows the reaction is exothermic? [1 mark]**

**Tick ONE box.**

**Mix zinc and copper oxide**

**Heat the mixture**

**Let the glow spread**

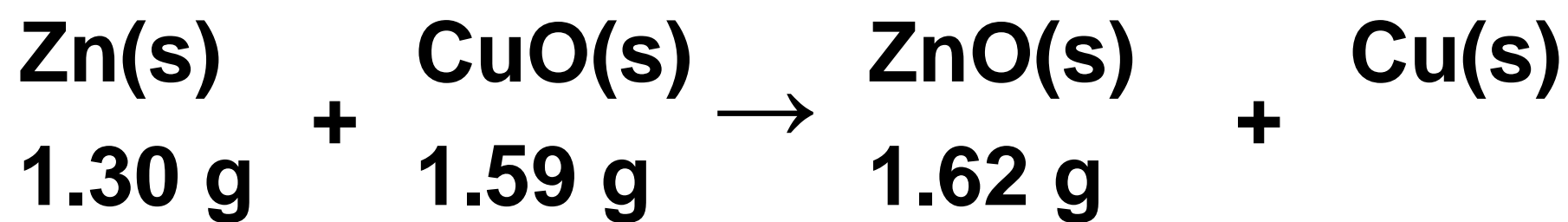
**Leave to cool**

**[Turn over]**



6

The equation for the reaction between zinc and copper oxide is:



**0 1 . 2** 1.30 g of zinc fully reacted with 1.59 g of copper oxide to produce 1.62 g of zinc oxide.

**What mass of copper was produced? [1 mark]**

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**Mass of copper produced =**  
\_\_\_\_\_ **g**



**0 1 . 3** What is the physical state of zinc oxide in the reaction?  
[1 mark]

**Tick ONE box.**

**Aqueous**

**Gas**

**Liquid**

**Solid**

**[Turn over]**



**0 1 . 4** Which substance has been oxidised in the reaction?  
[1 mark]

**Tick ONE box.**

**Copper**

**Copper oxide**

**Zinc**

**Zinc oxide**



**0 1 . 5** What type of reaction takes place when zinc reacts with copper oxide? [1 mark]

**Tick ONE box.**

**Combustion**

**Crystallisation**

**Displacement**

**Neutralisation**

**[Turn over]**

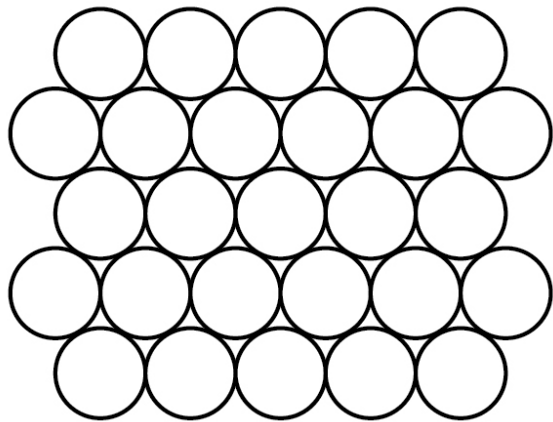


Copper is a metal.

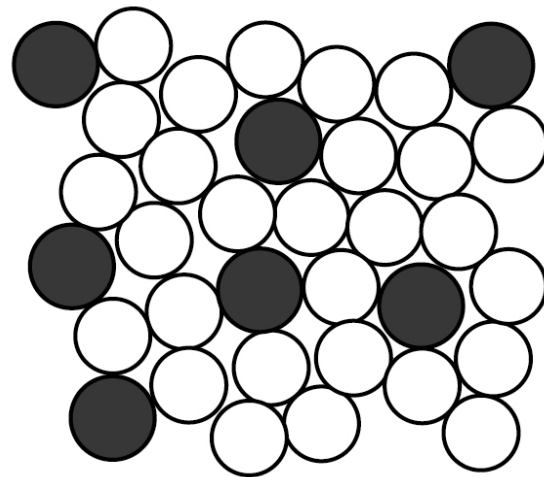
01.6

Which structure represents the arrangement of atoms in pure copper? [1 mark]

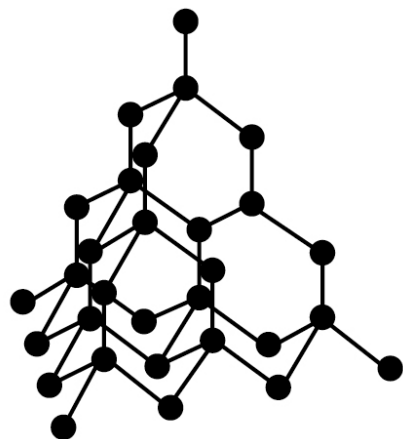
A



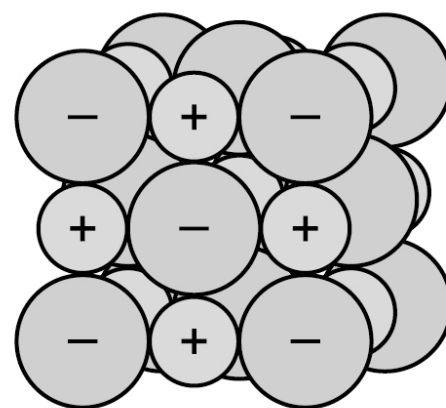
B



C



D



11

**Tick ONE box.****A****B****C****D****01.7****Copper is used in electrical wiring.****Give ONE reason why.****[1 mark]**

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**[Turn over]**

**0 1 . 8** In the UK, 40% of the copper we use is recycled copper.

The other 60% is copper obtained by mining.

What is the simplest ratio of recycled copper to copper obtained by mining? [1 mark]

Tick ONE box.

**2 : 3**

**2 : 5**

**4 : 10**

**6 : 4**

**01.9** What are TWO advantages of recycling copper? [2 marks]

**Tick TWO boxes.**

**Conserves copper ores**

**Increase in greenhouse gases**

**Less energy used**

**More jobs for miners**

**More space used at landfill**

**[Turn over]**

<b>10</b>

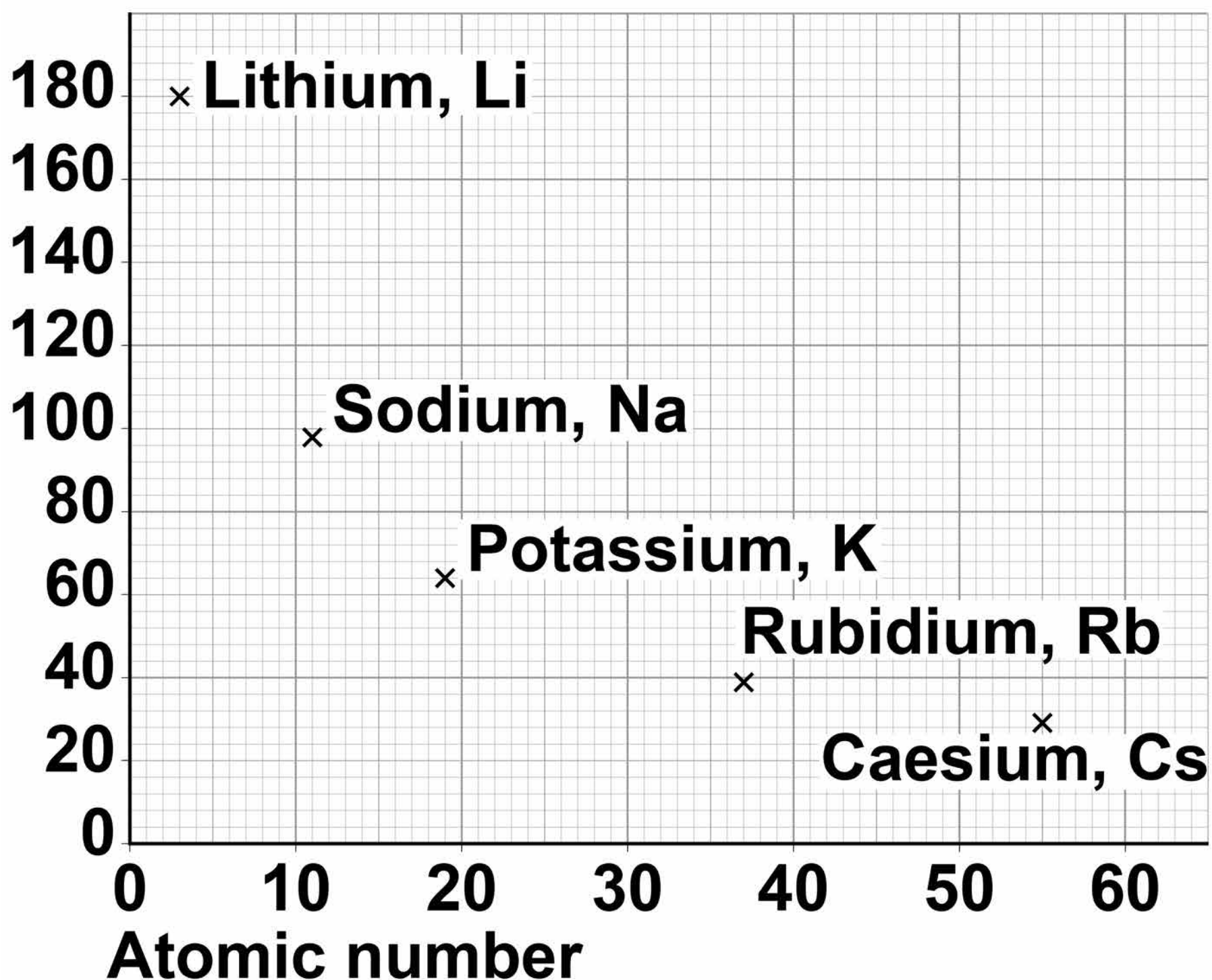


**0 2** This question is about Group 1 metals.

**FIGURE 1** shows the melting points of Group 1 metals plotted against their atomic number.

**FIGURE 1**

**Melting  
point  
in °C**



**0 2 . 1** Describe the trend shown by the melting points of Group 1 metals as the atomic number increases. [1 mark]

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**0 2 . 2** Determine the atomic number and melting point of caesium.

**Use FIGURE 1. [1 mark]**

**Atomic number of caesium =**

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**Melting point of caesium =**

**\_\_\_\_\_ °C**

**[Turn over]**



16

Lithium is a Group 1 metal.

**0 2 . 3** A lithium atom can be shown  
as  ${}^7_3\text{Li}$

How many electrons does the  
**OUTER SHELL** of a lithium  
atom contain? [1 mark]

Tick **ONE** box.

1

3

4

7





**0 2 . 4** Lithium reacts with oxygen to produce lithium oxide.

**Draw ONE line from each substance to the correct description of the substance.  
[2 marks]**

**SUBSTANCE**

**DESCRIPTION**

**Lithium oxide**

**Oxygen**

**compound**

**element**

**metal**

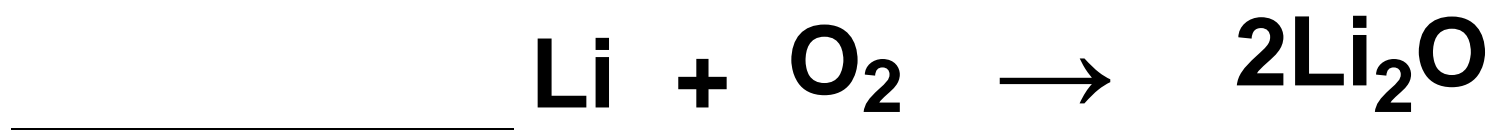
**mixture**

**polymer**

**[Turn over]**



**0 2 . 5** Balance the equation for the reaction of lithium with oxygen.  
[1 mark]



**0 2 . 6** What type of bonding is present in lithium oxide?  
[1 mark]

**Tick ONE box.**

**Covalent**

**Ionic**

**Metallic**

**0 2 . 7** Calculate the relative formula mass ( $M_r$ ) of lithium oxide ( $\text{Li}_2\text{O}$ ).

**Relative atomic masses ( $A_r$ ):**  
**Li = 7   O = 16 [2 marks]**

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**Relative formula mass =**

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**[Turn over]**

<b>9</b>

**0 3**

**The stopping distance of a car depends on the thinking distance and the braking distance.**

**0 3 . 1**

**Thinking distance depends on the driver's reaction time.**

**Give TWO factors that can affect reaction time. [2 marks]**

**1**

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**2**

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**0 3 . 2**

**Give ONE factor that can affect the braking distance. [1 mark]**

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**03.3** The thinking distance is the distance travelled during the driver's reaction time.

**A car was travelling at 13 m/s**

**The driver's reaction time was 0.6 s**

**Calculate the thinking distance.**

**Use the equation:**

**distance travelled =  
speed × time**

**[2 marks]**

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**Thinking distance =**

**\_\_\_\_\_ m**

**[Turn over]**



**03.4** The braking distance of the car was 14.0 m

**What was the stopping distance of the car? [1 mark]**

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**Stopping distance =**

\_\_\_\_\_ m

**03.5** What is the link between speed and braking distance?

**Complete the sentence. [1 mark]**

**The greater the speed, the**

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**03.6**

If a large braking force is applied, the car decelerates and stops in a very short distance.

Give TWO disadvantages of applying a large braking force.  
[2 marks]

1

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2

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[Turn over]

9



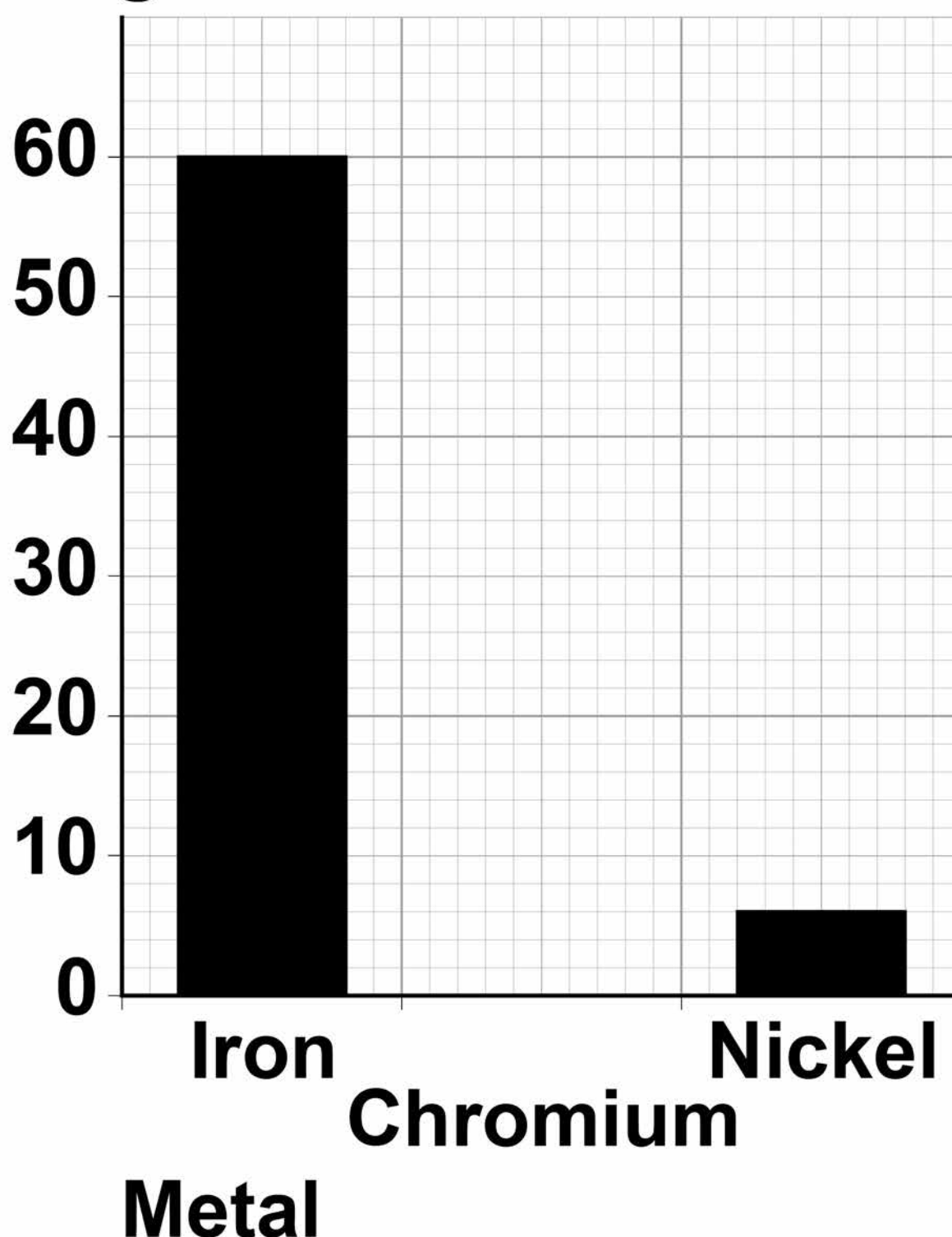
**0 4**

One alloy contains iron, chromium and nickel.

**FIGURE 2** shows the mass of iron and the mass of nickel in 80 g of this alloy.

**FIGURE 2**

**Mass  
in g**





- 04.1** Determine the mass of iron and nickel in 80 g of the alloy.  
[1 mark]

Use FIGURE 2.

Mass of iron = \_\_\_\_\_ g

Mass of nickel = \_\_\_\_\_ g

- 04.2** Calculate the mass of chromium in 80 g of the alloy.

Draw a bar on FIGURE 2 to show the mass of chromium in 80 g of the alloy. [2 marks]

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Mass of chromium = \_\_\_\_\_ g

[Turn over]



26

**04.3**

What mass of iron is present in 0.80 kg of the alloy?

Give your answer in grams.  
[1 mark]

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Mass of iron = \_\_\_\_\_ g

**04.4**

What is an alloy? [1 mark]

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**04.5**

**Give ONE reason why alloys are used instead of pure metals.  
[1 mark]**

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**[Turn over]**



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**0 4 . 6** Iron and nickel are both magnetic metals.

**Which is also a magnetic metal? [1 mark]**

**Tick ONE box.**

**Cobalt**

**Copper**

**Sodium**

**Zinc**

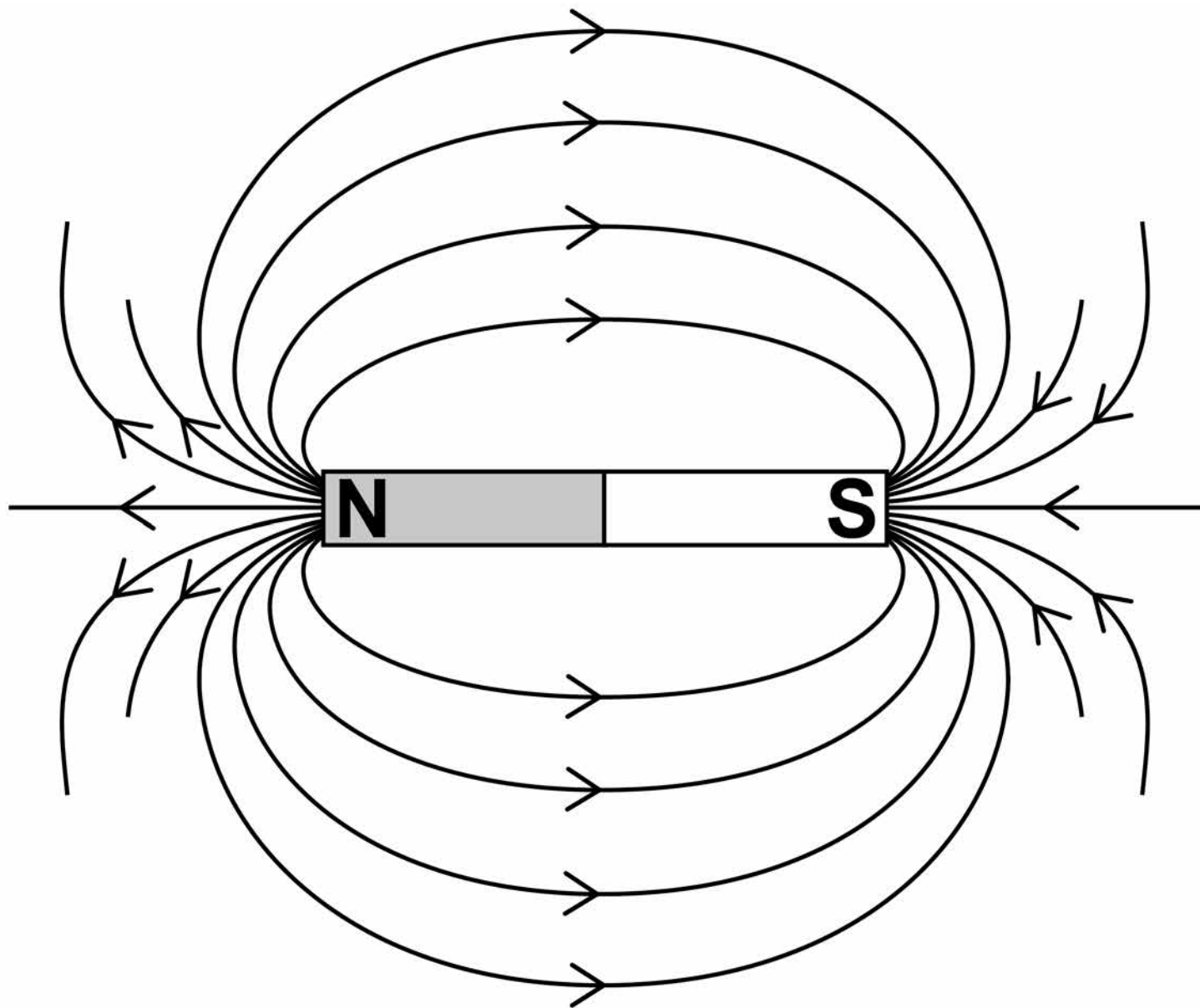
**[Turn over]**



**A student plotted the magnetic field pattern around a bar magnet.**

**FIGURE 3 shows the magnetic field pattern.**

**FIGURE 3**



**04.7 Complete the sentence.**

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

- **induced**
- **permanent**
- **temporary**

**Bar magnets produce their own magnetic fields.**

**Bar magnets are described as \_\_\_\_\_ magnets.**

**[Turn over]**



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**0 4 . 8** Which statement about the magnetic field around a bar magnet is correct? [1 mark]

**Tick ONE box.**

**The magnetic field is the same strength all around the magnet.**

**The magnetic field is strongest at the poles of the magnet.**

**The magnetic field is strongest near the middle of the magnet.**

**[Turn over]**



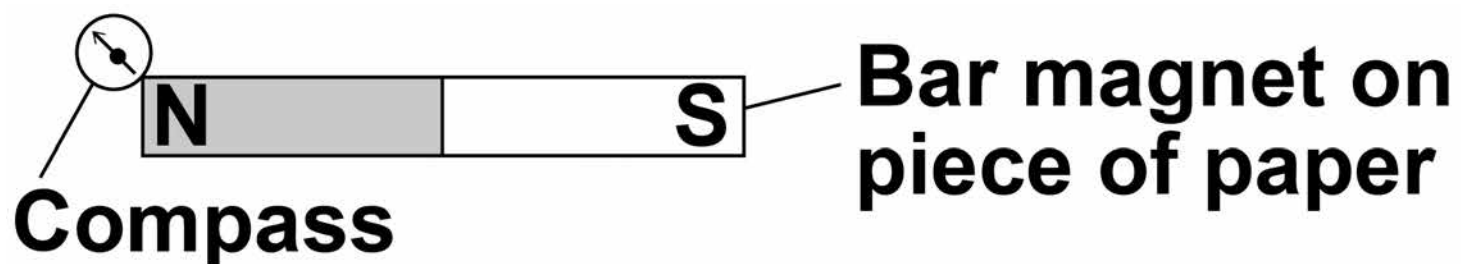
**04.9**

This is the start of a method used to plot a magnetic field pattern around a bar magnet.

1. Place the magnet on a piece of paper.
2. Draw around the magnet.
3. Mark a dot by a pole of the magnet.
4. Place the compass on the dot.

FIGURE 4 shows the apparatus after steps 1–4.

FIGURE 4



Describe the rest of the method to plot the magnetic field pattern. [4 marks]



**0 5**

**A student investigated the rate of reaction of magnesium with dilute hydrochloric acid.**

**This is the method used.**

- 1. Add 50 cm<sup>3</sup> of dilute hydrochloric acid to a conical flask.**
- 2. Add 0.2 g of magnesium ribbon to the dilute hydrochloric acid in the conical flask.**
- 3. Attach a gas syringe to the conical flask.**
- 4. Record the volume of gas in the gas syringe every 10 seconds.**

**FIGURE 5, on page 38, shows the student's results.**

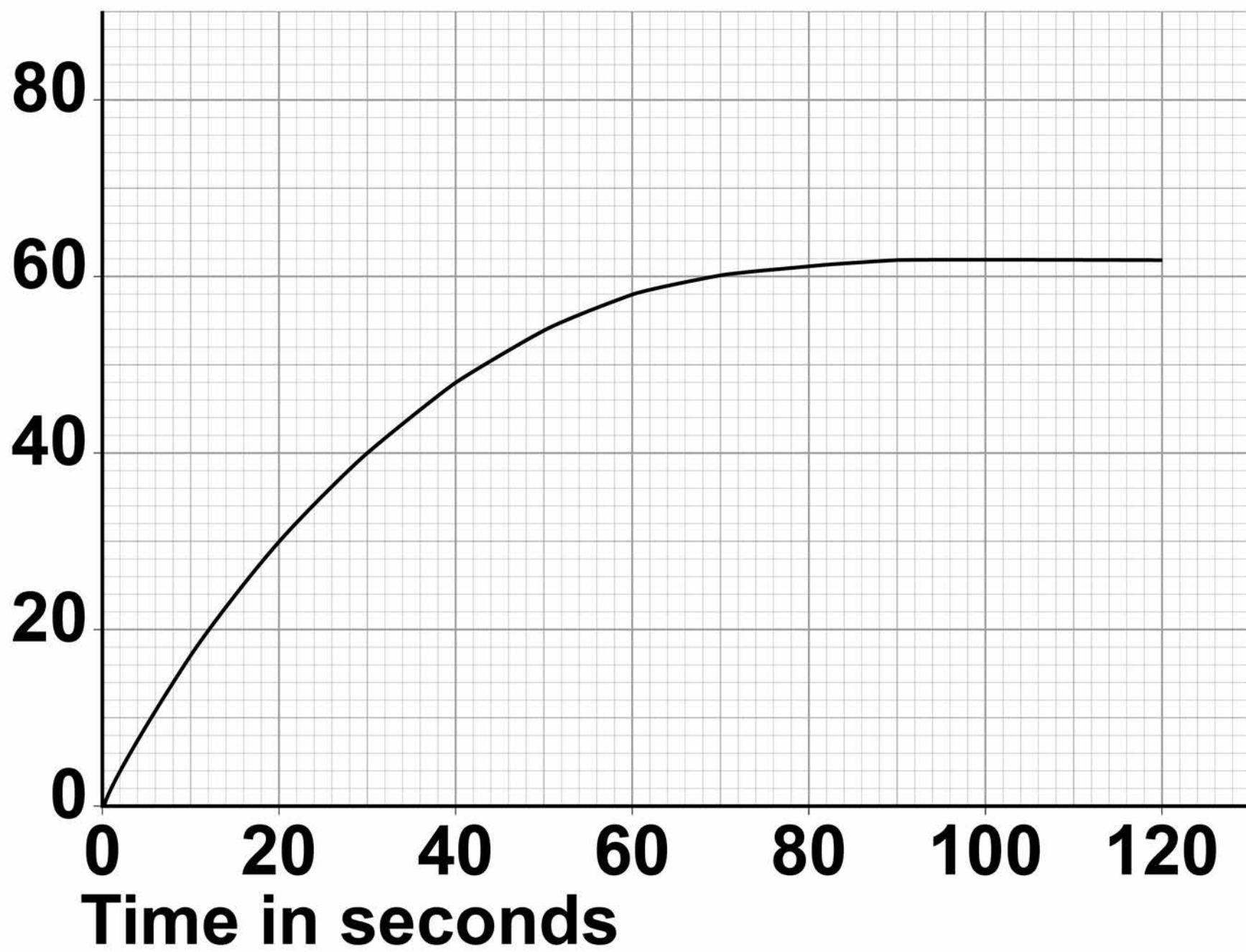
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**[Turn over]**



**FIGURE 5**

**Volume  
of gas  
in cm<sup>3</sup>**



**0 5 . 1** Calculate the mean rate of reaction in the first 10 seconds.

Use **FIGURE 5** and the equation:

mean rate of reaction =

volume of gas produced after 10 seconds  
time taken

**[2 marks]**

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Mean rate of reaction =

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**[Turn over]**



40

**05.2** What is the unit for the mean rate of the reaction calculated in Question 05.1? [1 mark]

**Tick ONE box.**

**cm<sup>3</sup>/s**

**g/s**

**s/cm<sup>3</sup>**

**s/g**





**0 5 . 3** Give TWO conclusions you can make about the reaction from 90 s to 120 s

**Use FIGURE 5, on page 38.  
[2 marks]**

**1** \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**2** \_\_\_\_\_

\_\_\_\_\_

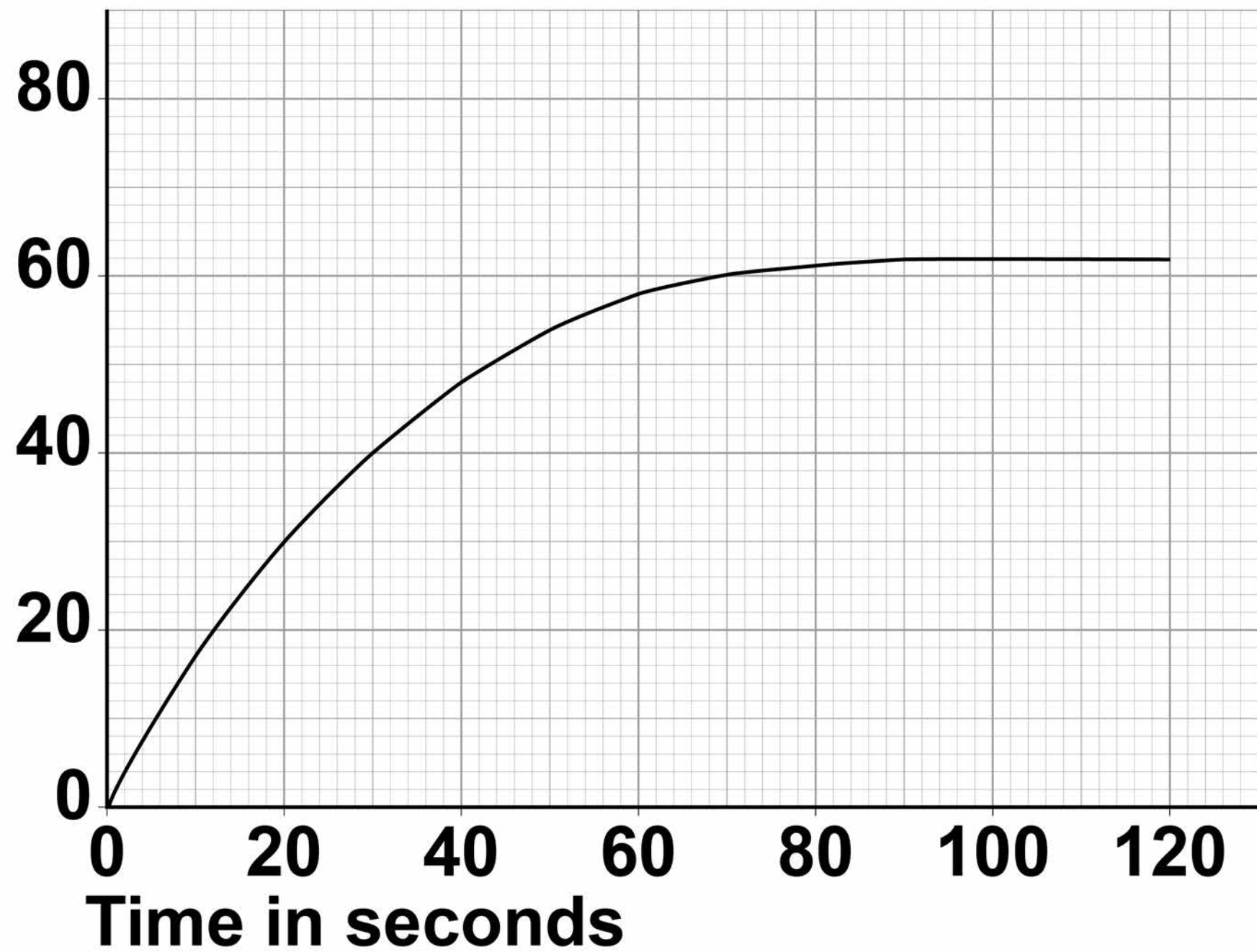
\_\_\_\_\_

**[Turn over]**



## Repeat of FIGURE 5

Volume  
of gas  
in  $\text{cm}^3$



43

The student repeated the method using magnesium powder instead of magnesium ribbon. All other variables were kept the same.

**0 5 . 4** What is the independent variable in the investigation? [1 mark]

**Tick ONE box.**

**Surface area of magnesium**

**Temperature of reaction**

**Volume of gas collected**

**Volume of hydrochloric acid**

**0 5 . 5** Sketch a line on FIGURE 5, on page 42, to show the expected results for the experiment using magnesium powder. [2 marks]

**[Turn over]**

<b>8</b>



0	6
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**A teacher demonstrated the temperature change when hydrochloric acid is added to sodium hydroxide.**

**This is the method used.**

- 1. Add 25.0 cm<sup>3</sup> of sodium hydroxide solution to a polystyrene cup.**
- 2. Measure the temperature of the sodium hydroxide solution.**
- 3. Add 25.0 cm<sup>3</sup> of hydrochloric acid to the sodium hydroxide solution.**
- 4. Stir the solution.**
- 5. Measure the maximum temperature of the solution.**



- 06.1** Draw ONE line from each measurement to the most suitable piece of equipment to use to make the measurement.  
[2 marks]

**MEASUREMENT****EQUIPMENT**

Temperature of solution

Volume of hydrochloric acid

balance

beaker

measuring cylinder

metre rule

thermometer

[Turn over]



**06.2** The teacher did the experiment four times.

**TABLE 1** shows the teacher's results.

**TABLE 1**

<b>Experiment</b>	<b>Maximum temperature rise in °C</b>
<b>1</b>	<b>6.1</b>
<b>2</b>	<b>7.8</b>
<b>3</b>	<b>6.1</b>
<b>4</b>	<b>6.4</b>

47

**Calculate the mean maximum temperature rise.**

**Do NOT use the anomalous result in your calculation.  
[2 marks]**

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**Mean maximum temperature rise \_\_\_\_\_ °C**

**[Turn over]**



**0 6 . 3** How could the accuracy of the experiment be improved?  
[1 mark]

**Tick ONE box.**

**Add 20.0 cm<sup>3</sup> of hydrochloric acid**

**Use a lid on the polystyrene cup**

**Use a metal beaker**

**Use a thermometer with a resolution of 1 °C**





The reaction between hydrochloric acid and sodium hydroxide is a neutralisation reaction.

The reaction produces a salt and one other product.

**0 6 . 4** Complete the word equation for the reaction. [2 marks]

hydrochloric acid + sodium hydroxide  
→ \_\_\_\_\_ + \_\_\_\_\_

[Turn over]



50

**06.5** Universal indicator is used to measure the pH of solutions.

**Hydrochloric acid is pH 1**

**Sodium hydroxide is pH 13**

**Draw ONE line from the pH to the colour of universal indicator in a solution with that pH. [2 marks]**



**pH**

**Colour of  
universal  
indicator**

**1**

**green**

**orange**

**13**

**purple**

**red**

**yellow**

**[Turn over]**

**9**



**07**

**An athlete trains to improve his fitness by walking, cycling and running.**

**07.1**

**What is a typical mean speed for a person walking? [1 mark]**

**Tick ONE box.**

**1.5 m/s****3.0 m/s****4.5 m/s****6.0 m/s**

**07.2** What is a typical mean speed for a person cycling? [1 mark]

**Tick ONE box.**

**1.5 m/s**

**3.0 m/s**

**4.5 m/s**

**6.0 m/s**

**[Turn over]**

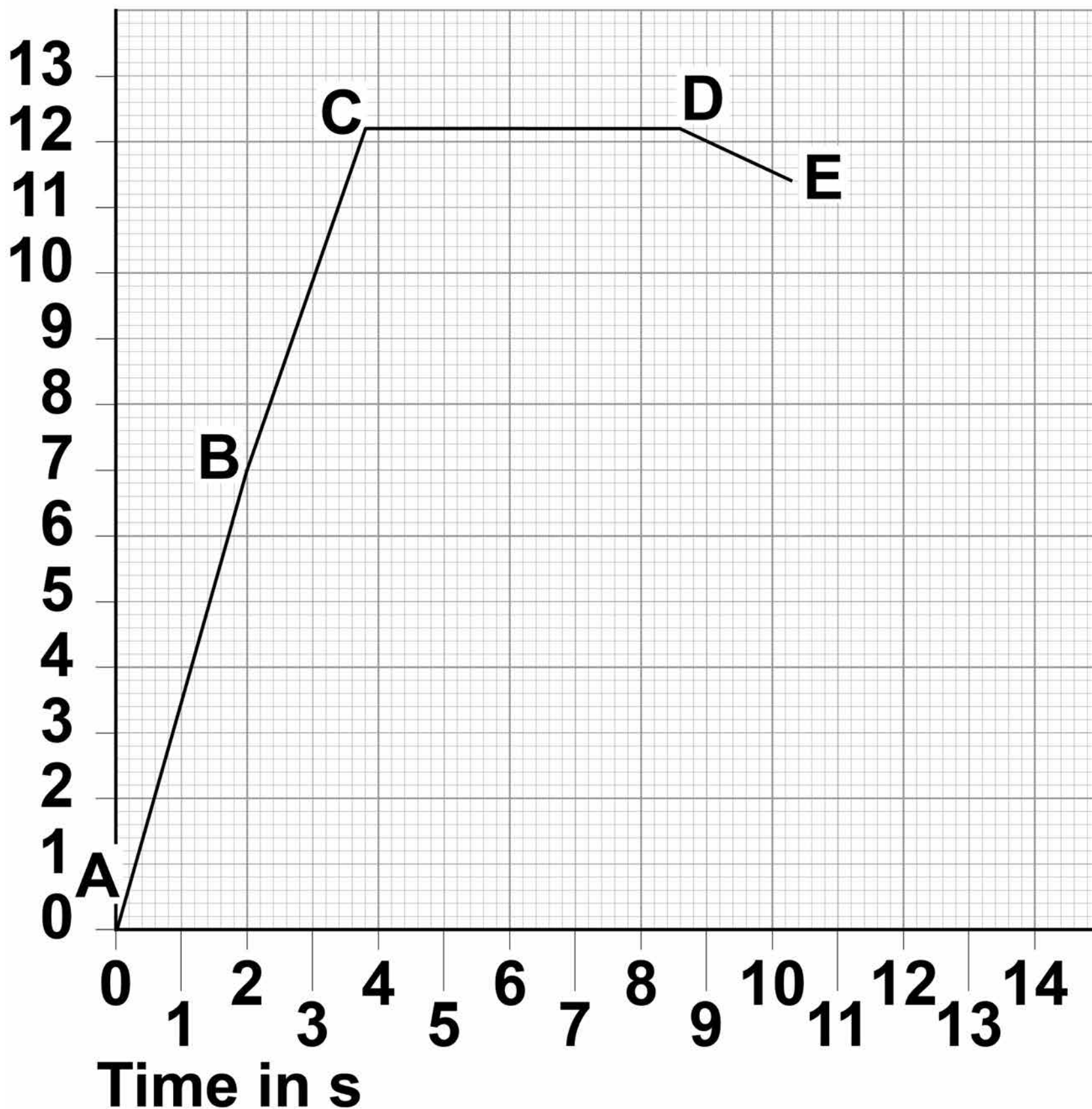


The athlete takes part in a race on a straight, horizontal running track.

FIGURE 6 shows the velocity-time graph for the athlete. A, B, C, D and E represent points in the race.

**FIGURE 6**

Velocity  
in m/s



55

**07.3** Determine the time taken for the athlete to move between points C and D. [2 marks]

Time at C = \_\_\_\_\_ s

Time at D = \_\_\_\_\_ s

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Time taken between points

C and D = \_\_\_\_\_ s

**07.4** Point E represents the end of the race.

After point E, the athlete has a constant deceleration.

The athlete stops 14 seconds after the start of the race.

Complete FIGURE 6 to show the motion of the athlete after point E. [2 marks]



[Turn over]

**07.5** Which section of the graph in **FIGURE 6**, on page 54, shows the athlete moving at constant velocity? [1 mark]

**Tick ONE box.**

**A–B**

**B–C**

**C–D**

**D–E**



**07.6** Which section of the graph in **FIGURE 6** represents a part of the race where the resultant force on the athlete is zero?  
[1 mark]

**Tick ONE box.**

**A–B**

**B–C**

**C–D**

**D–E**

**[Turn over]**



**07.7** What does the area under a velocity-time graph represent? [1 mark]

Tick ONE box.

**Acceleration**

**Distance travelled**

**Energy**

**Speed**

**07.8** Write the equation which links acceleration, mass and resultant force. [1 mark]

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59

**07.9**

In another race, the athlete had a constant acceleration during the first 3.2 seconds. His velocity increased from 0 m/s to 11.6 m/s

Calculate the acceleration of the athlete.

Use the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

[2 marks]

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Acceleration = \_\_\_\_\_ m/s<sup>2</sup>

[Turn over]

12



60

**0 8**

This question is about hydrogen chloride.

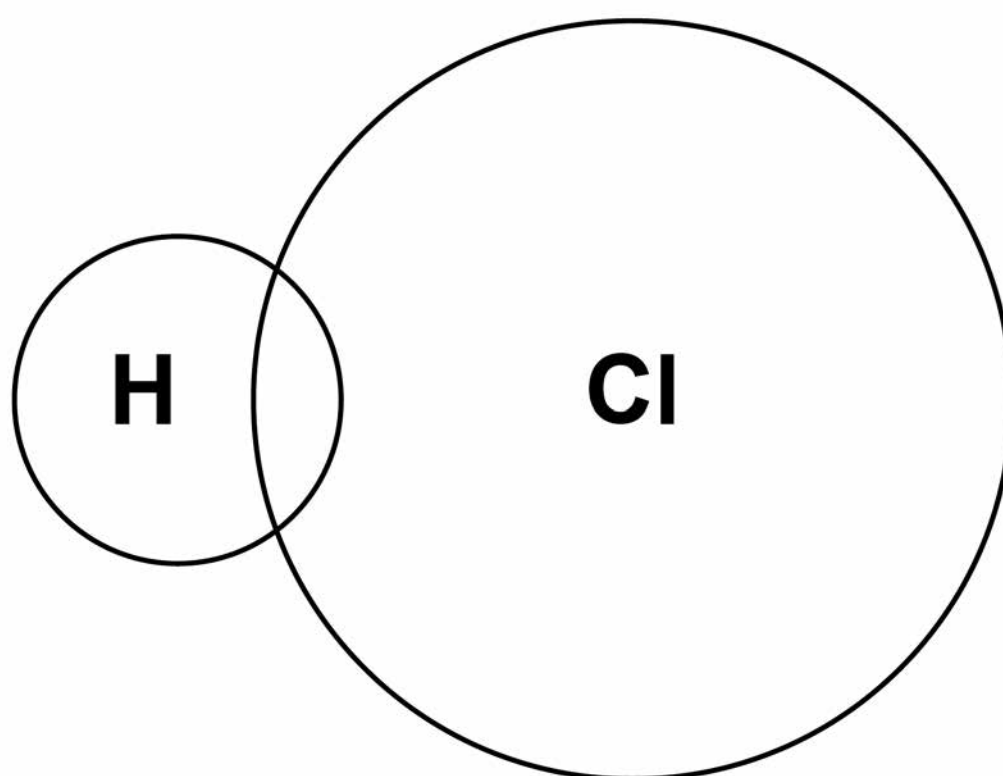
**0 8 . 1**

A hydrogen atom contains 1 electron and a chlorine atom contains 17 electrons.

Complete FIGURE 7 to show a dot and cross diagram for a hydrogen chloride molecule.

Show the outer electrons only.  
[2 marks]

**FIGURE 7**



Hydrogen gas ( $\text{H}_2$ ) reacts with chlorine gas to produce hydrogen chloride.



61

**0 8 . 2** Complete the balanced chemical equation for the reaction between hydrogen and chlorine.  
[2 marks]

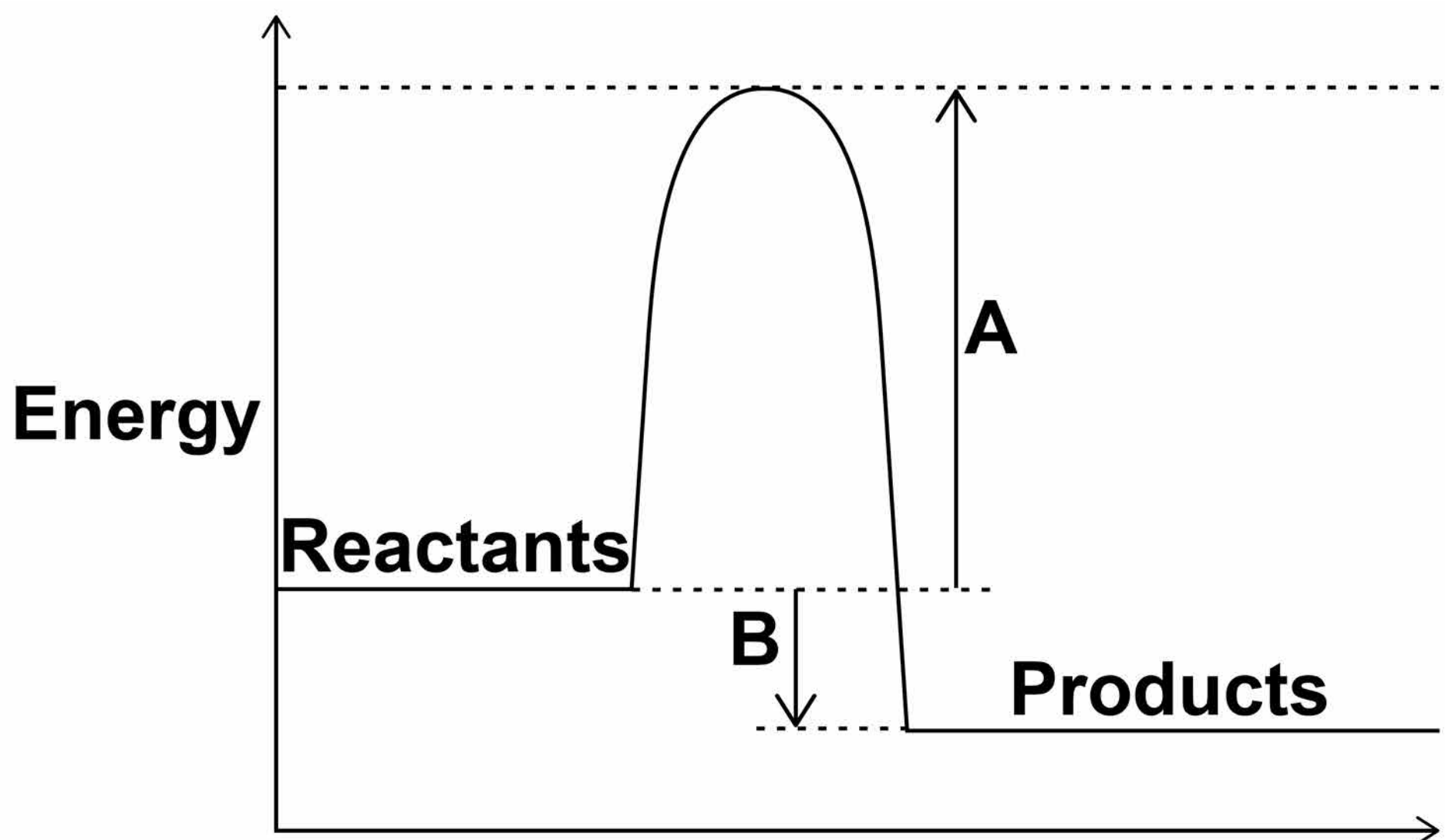


**[Turn over]**



**FIGURE 8** shows the reaction profile diagram for the reaction between hydrogen and chlorine.

**FIGURE 8**



**0 8 . 3** What do A and B represent on FIGURE 8? [2 marks]

A \_\_\_\_\_

\_\_\_\_\_

B \_\_\_\_\_

\_\_\_\_\_

**0 8 . 4** How does the reaction profile diagram show that the reaction is exothermic? [1 mark]

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**[Turn over]**



**08.5**

**Hydrogen chloride gas dissolves in water to form hydrochloric acid.**

**Hydrochloric acid contains hydrogen ions and chloride ions.**

**Explain why hydrogen chloride gas does NOT conduct electricity but hydrochloric acid is able to conduct electricity. [3 marks]**

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**[Turn over]**

<b>10</b>



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**0 9**

**When a metal carbonate reacts with an acid, a salt, carbon dioxide and water are produced.**

**0 9 . 1**

**Describe how you would test for carbon dioxide gas.**

**Give the result of the test.**

**[2 marks]**

**Test**

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**Result**

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**[Turn over]**







**1 0**

**An energy input of  $1.3 \times 10^{18}$  J is supplied each year by power stations to the National Grid.**

**Not all of this energy is supplied to consumers. Some of the energy is wasted in the distribution process.**

**1 0 . 1**

**Write the equation which links efficiency, total input energy transfer and useful output energy transfer. [1 mark]**

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71

**1 0 . 2** The energy supplied each year to consumers is  $1.2 \times 10^{18}$  J

**Calculate the efficiency of the distribution process. [2 marks]**

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**Efficiency =** \_\_\_\_\_

**[Turn over]**



**10.3** How is electrical power transmitted across the National Grid to make the process as efficient as possible?  
[1 mark]

**Tick ONE box.**

**At a high potential difference and a high current**

**At a high potential difference and a low current**

**At a low potential difference and a high current**

**At a low potential difference and a low current**





73

**1 0 . 4** Write the equation which links energy transferred, power and time. [1 mark]

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**[Turn over]**



**10.5**

**A wind turbine supplies a power output of 8000 kW for 1200 seconds.**

**Calculate the energy transferred by the wind turbine in kJ [3 marks]**

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**Energy transferred =**

**kJ**



75

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**[Turn over]**







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For Examiner's Use	
Question	Mark
1	
2	
3	
4	
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7	
8	
9	
10	
<b>TOTAL</b>	

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