



Surname _____

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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.**

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

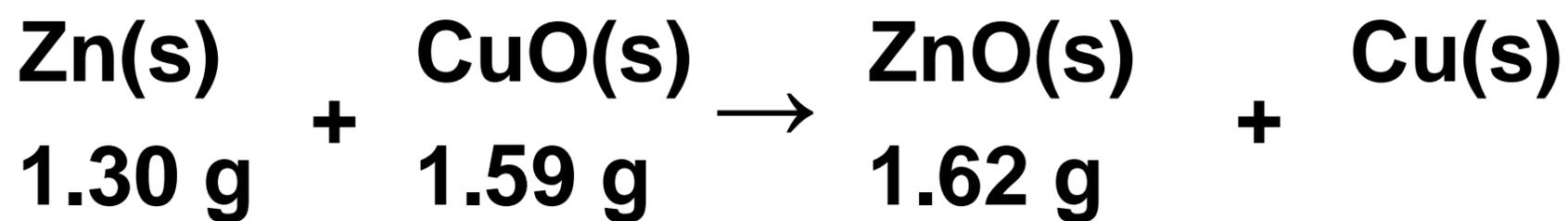
Let the glow spread

Leave to cool

[Turn over]



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]

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]



01.4 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

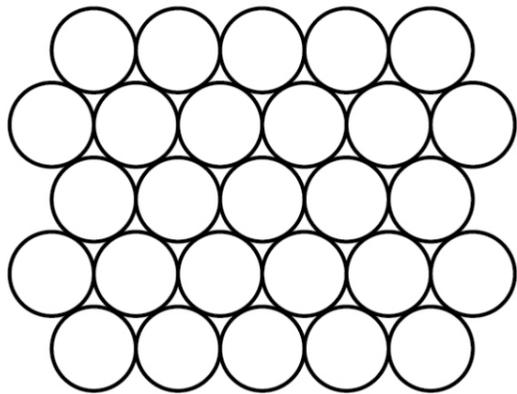
[Turn over]

Copper is a metal.

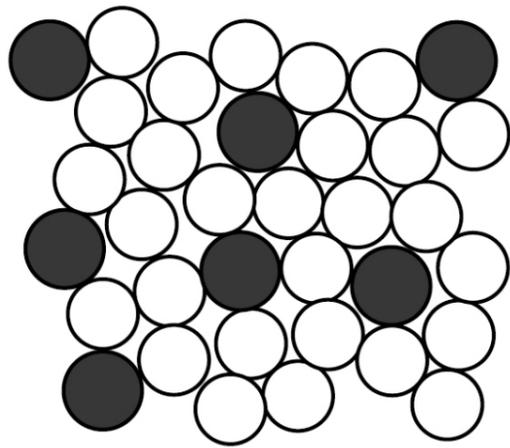
01.6

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

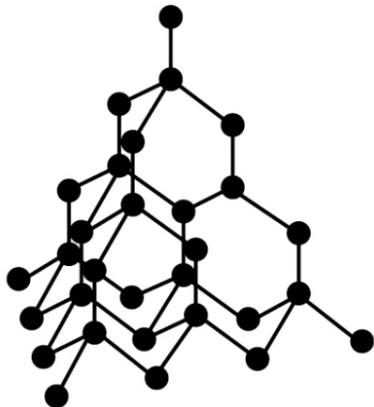
A



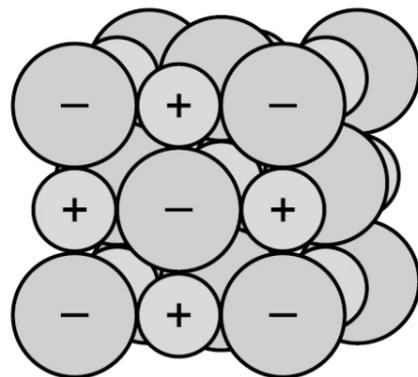
B



C



D



Tick ONE box.

A

B

C

D

0 1 . 7

Copper is used in electrical wiring.

Give ONE reason why.

[1 mark]

[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

0 1 . 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]

10

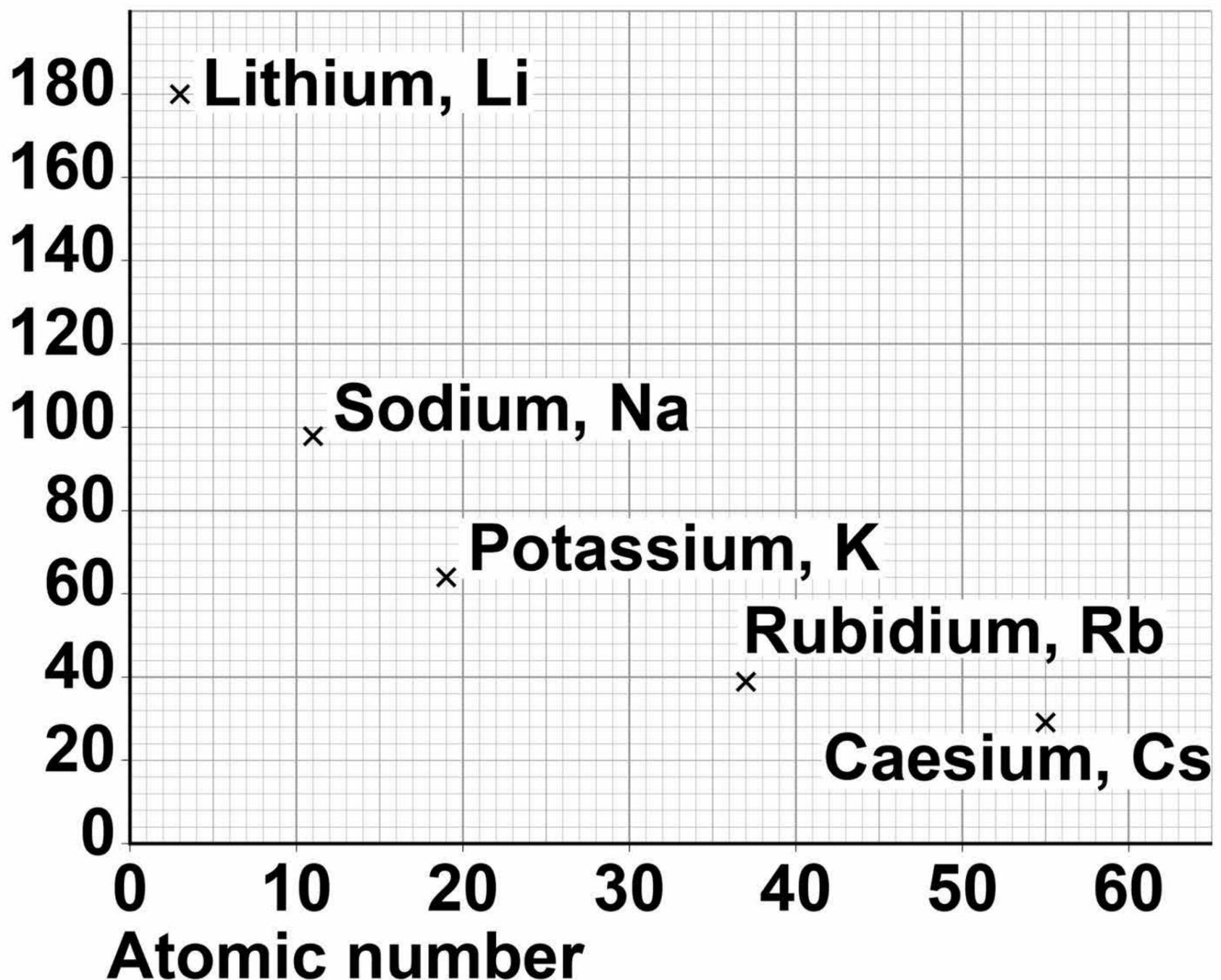


0 2 This question is about Group 1 metals.

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]

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

Use FIGURE 1. [1 mark]

Atomic number of caesium =

Melting point of caesium =

_____ °C

[Turn over]



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 (Li_2O).

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

Relative formula mass =

[Turn over]

9

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

2

0 3 . 2

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

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]

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]

Stopping distance =

_____ m

03.5 What is the link between speed and braking distance?

Complete the sentence. [1 mark]

The greater the speed, the

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

2

[Turn over]

9

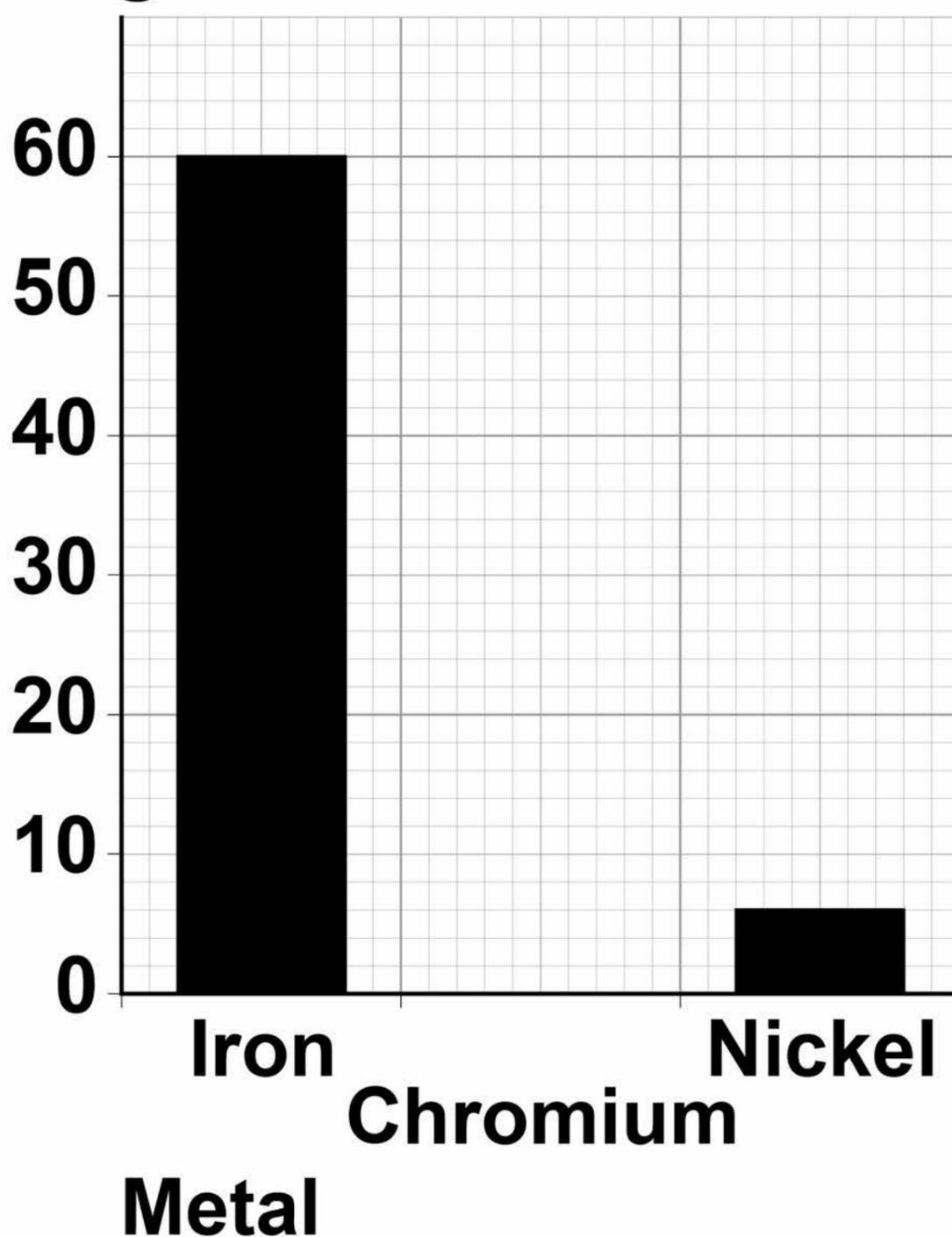
0 4

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]

Mass of chromium = _____ g

[Turn over]



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

**Give your answer in grams.
[1 mark]**

Mass of iron = _____ g

04.4 What is an alloy? [1 mark]

04.5

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

[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

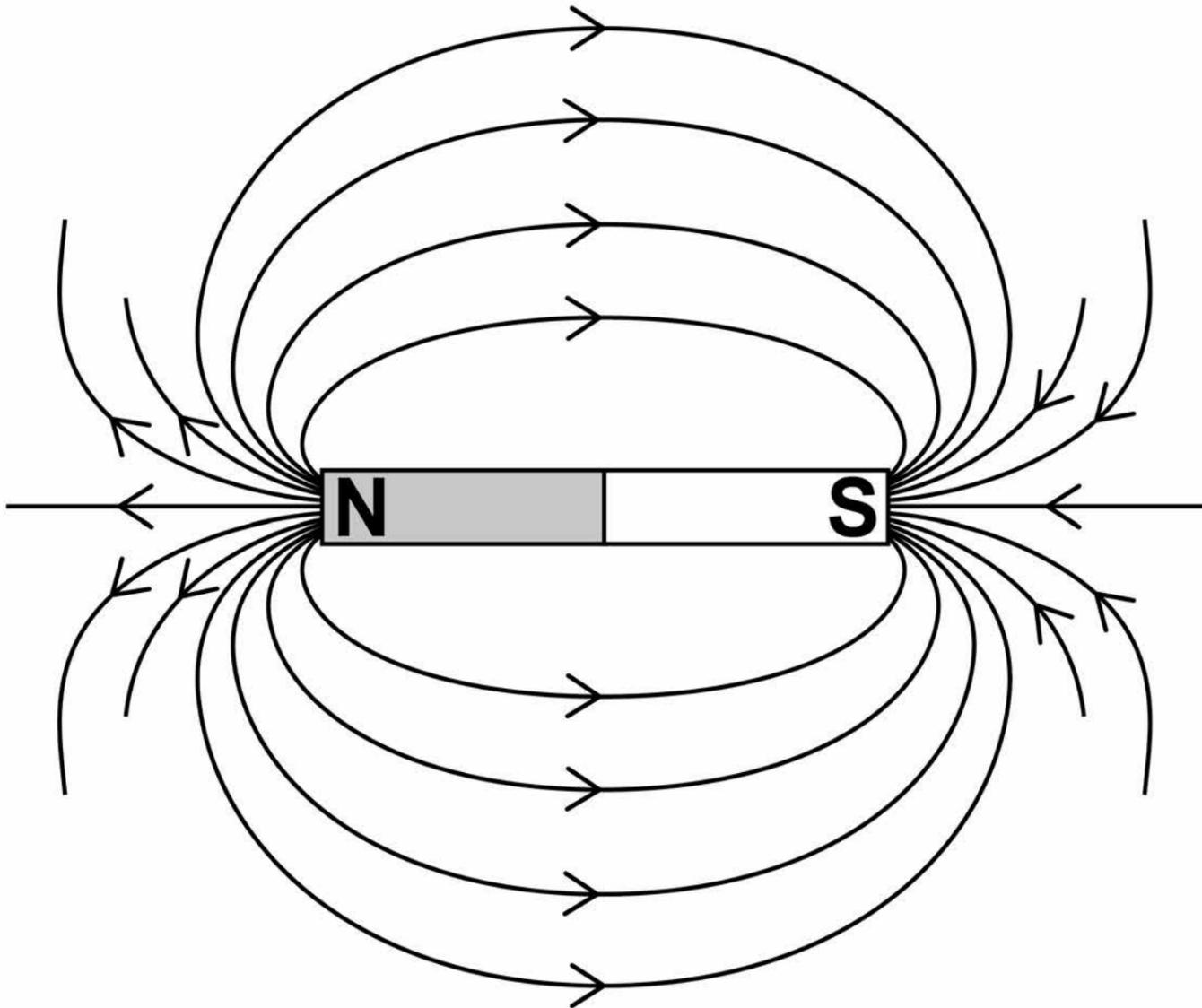
[Turn over]



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

FIGURE 3 shows the magnetic field pattern.

FIGURE 3



0 4 . 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]

BLANK PAGE



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]

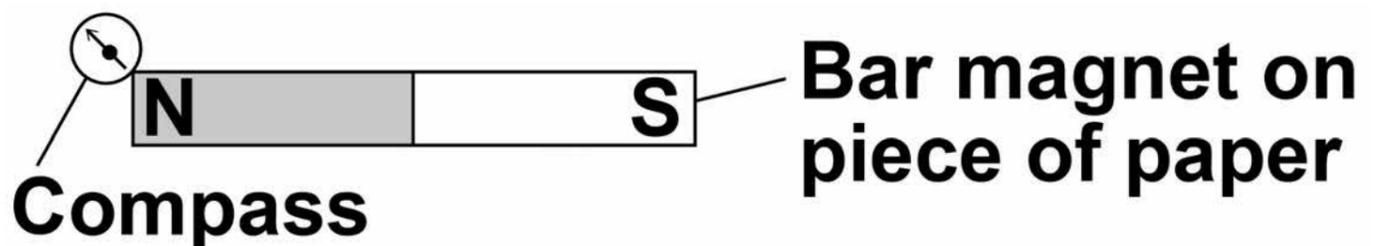
04.9

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]

05

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

This is the method used.

- 1. Add 50 cm³ 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.

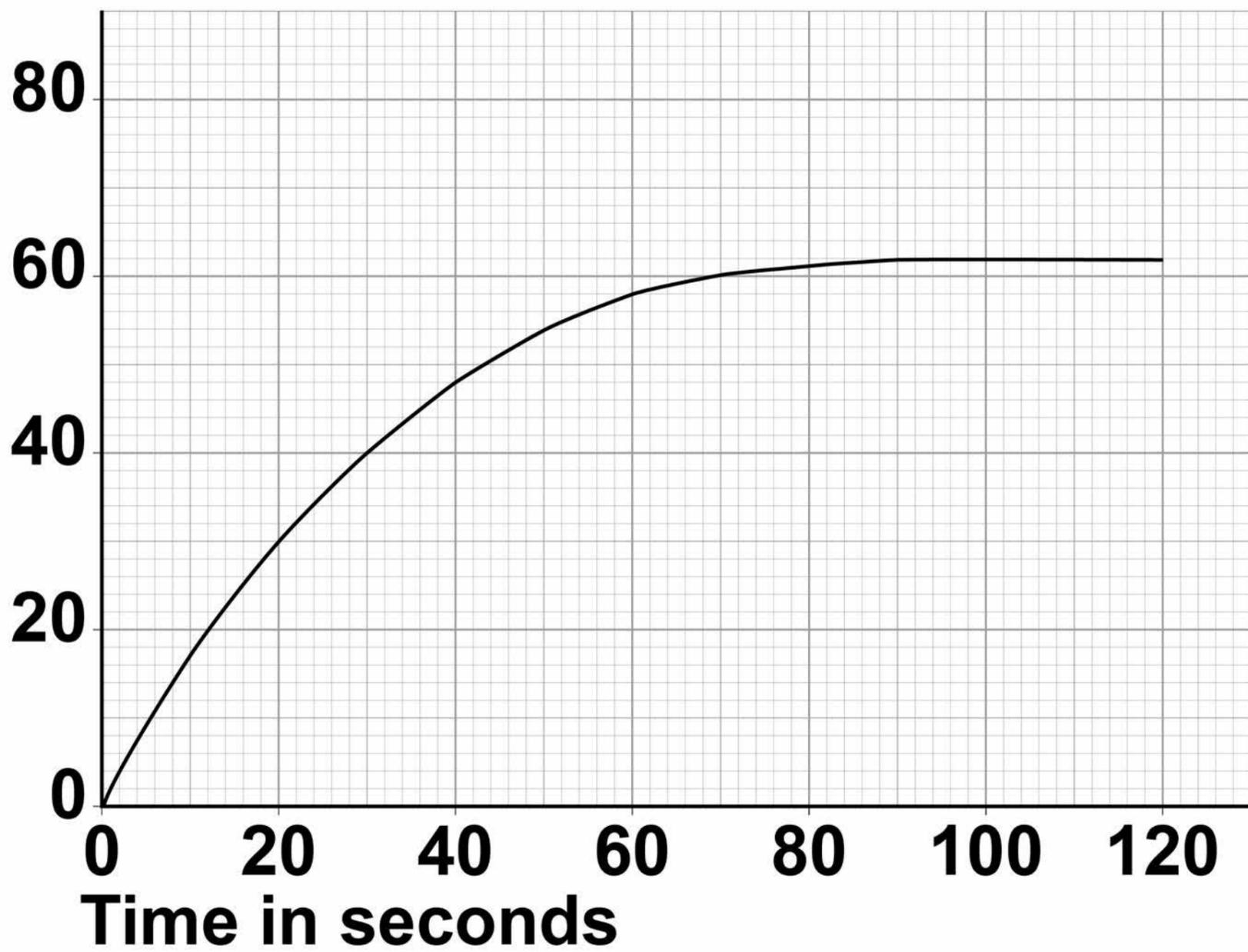
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[Turn over]



FIGURE 5

Volume
of gas
in cm^3



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]

Mean rate of reaction =

[Turn over]



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

Tick ONE box.

cm³/s

g/s

s/cm³

s/g

0 **5** . **3**

Give TWO conclusions you can make about the reaction from 90 s to 120 s

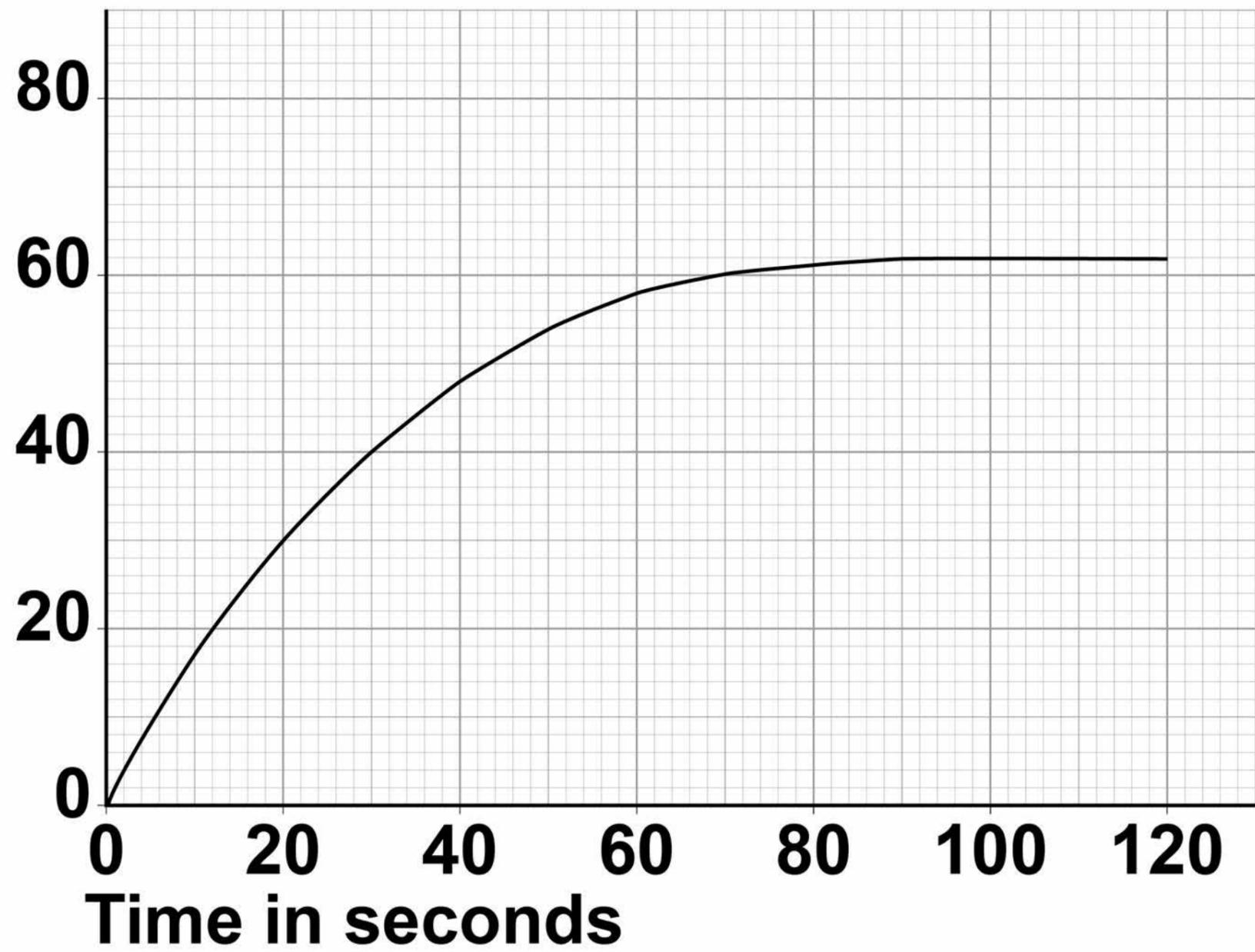
Use FIGURE 5, on page 38.

[2 marks]

1

2

[Turn over]

Repeat of FIGURE 5**Volume
of gas
in cm³**

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]



0	6
---	---

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

This is the method used.

- 1. Add 25.0 cm³ of sodium hydroxide solution to a polystyrene cup.**
- 2. Measure the temperature of the sodium hydroxide solution.**
- 3. Add 25.0 cm³ 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

Experiment	Maximum temperature rise in °C
1	6.1
2	7.8
3	6.1
4	6.4

Calculate the mean maximum temperature rise.

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

Mean maximum temperature rise _____ °C

[Turn over]

06.3 How could the accuracy of the experiment be improved?
[1 mark]

Tick ONE box.

Add 20.0 cm³ 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]

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

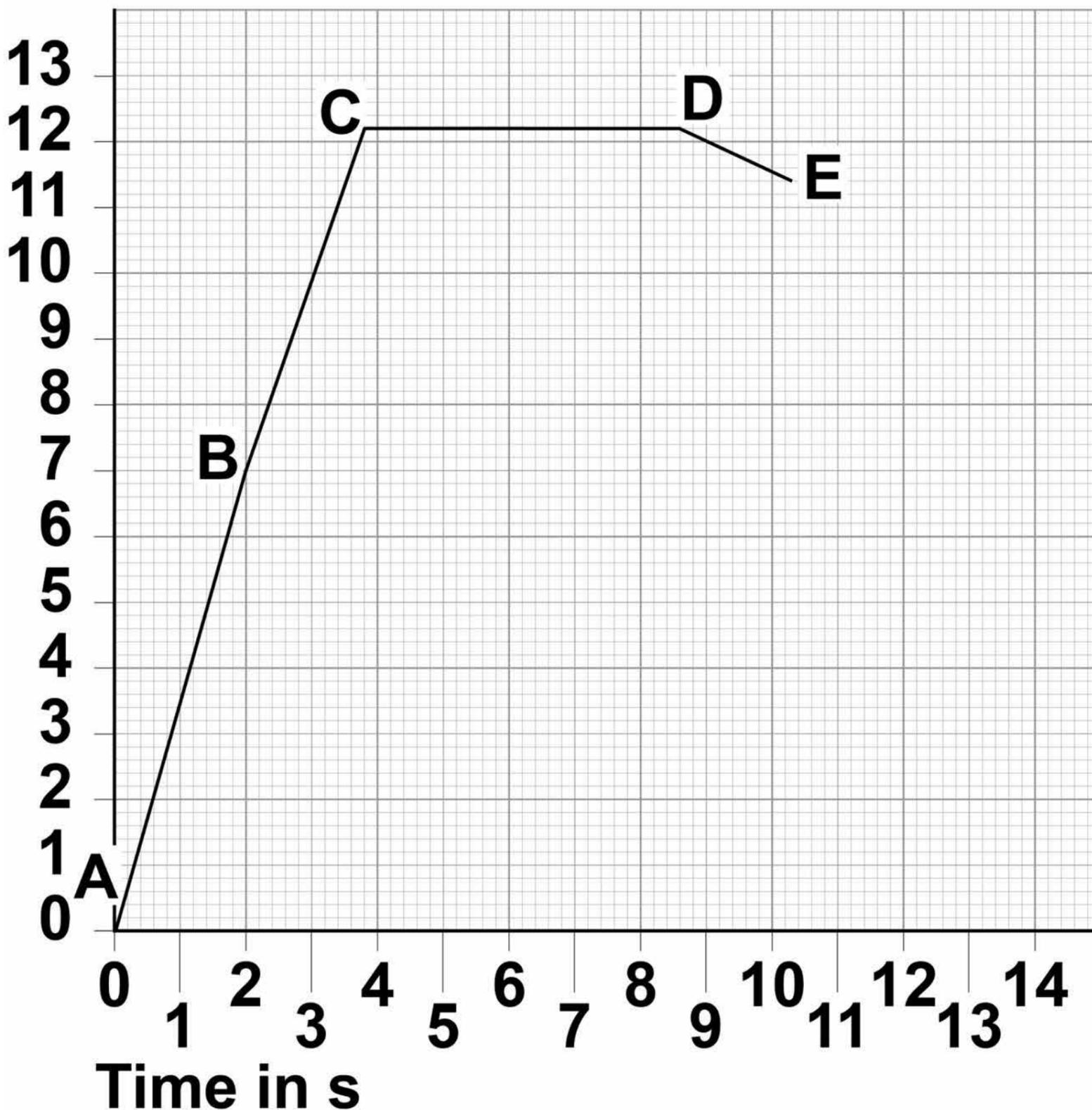
[Turn over]

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



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

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]



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]

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]

Acceleration = _____ m/s²

[Turn over]

12



0 8

This question is about hydrogen chloride.

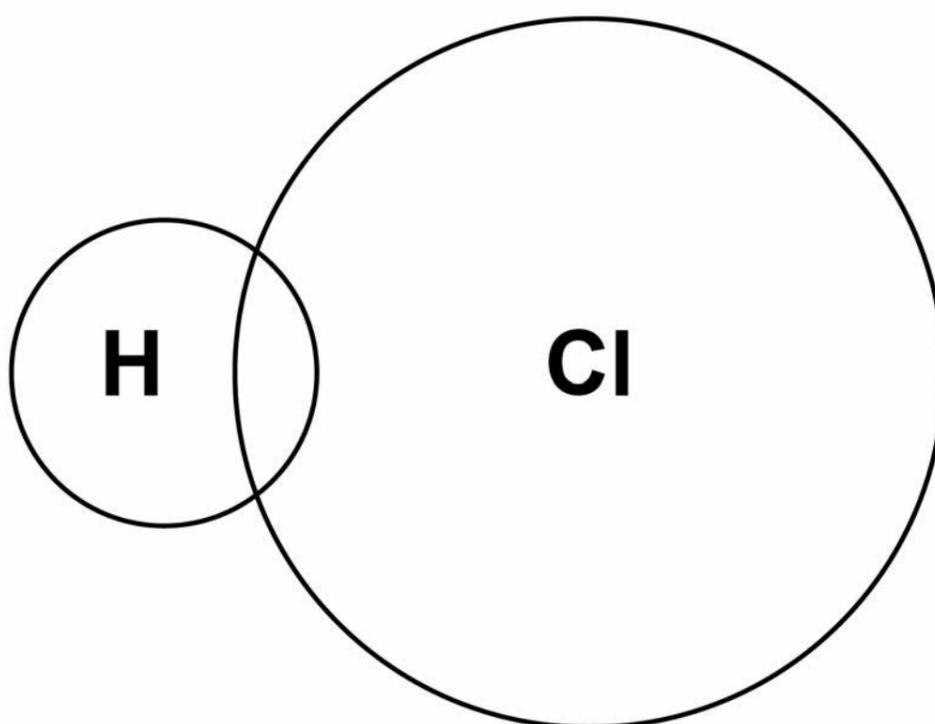
0 8 . 1

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 (H_2) reacts with chlorine gas to produce hydrogen chloride.

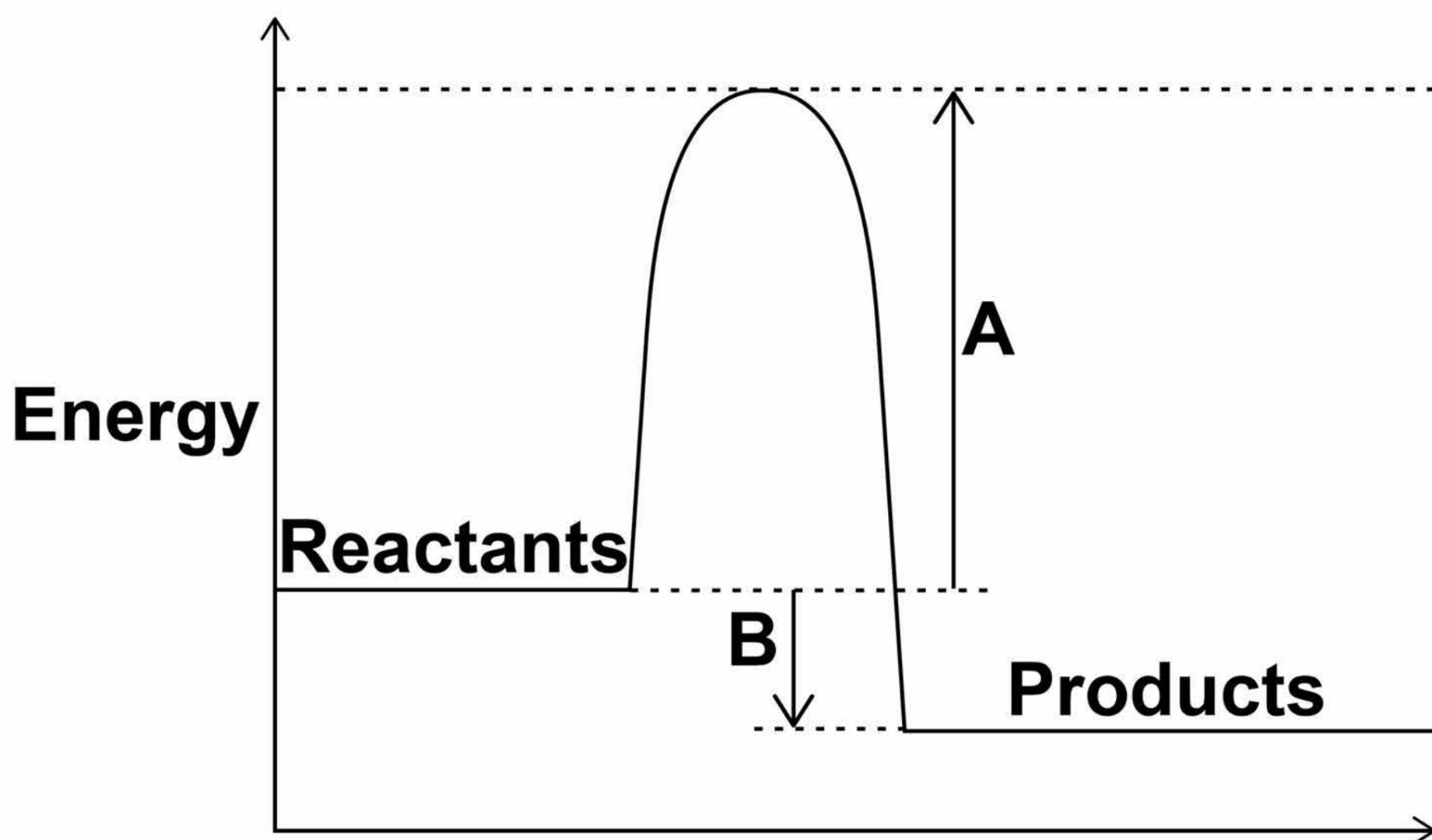
0 8 . 2 Complete the balanced chemical equation for the reaction between hydrogen and chlorine.
[2 marks]



[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]

0 8 . 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]

[Turn over]

10



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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

Result

[Turn over]



1 0

An energy input of 1.3×10^{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]

1 0 . 2 The energy supplied each year to consumers is 1.2×10^{18} J

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

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

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

[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]

Energy transferred =

kJ

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[Turn over]



There are no questions printed on this page

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

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