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A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE

COMBINED SCIENCE: SYNERGY

F

Foundation Tier **Paper 3 Physical sciences**

8465/3F

Monday 11 June 2018 **Morning**

Time allowed: 1 hour 45 minutes

For this paper you must have:
- **a ruler**
- **a scientific calculator**
- **the periodic table (enclosed)**
- **the Physics Equations Sheet (enclosed).**

At the top of the page, write your surname and other names, your centre number, your candidate number and add your signature.

[Turn over]

J U N 1 8 8 4 6 5 3 F 0 1

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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

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0 1 **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.**

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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**

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

Zn(s)	+	CuO(s)	→	ZnO(s)	+	Cu(s)
1.30 g		1.59 g		1.62 g		

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**

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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]

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

Tick ONE box.

- ☐ **Copper**
- ☐ **Copper oxide**
- ☐ **Zinc**
- ☐ **Zinc oxide**

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

Tick ONE box.

- ☐ **Combustion**
- ☐ **Crystallisation**
- ☐ **Displacement**
- ☐ **Neutralisation**

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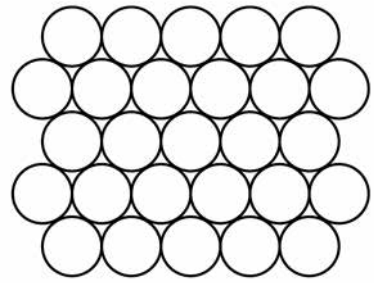
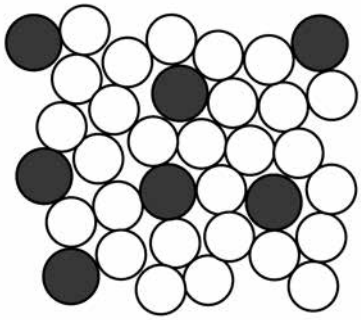
Copper is a metal.

0 1 . 6 **Which structure represents the arrangement of atoms in pure copper? [1 mark]**

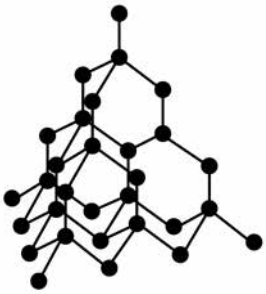
A



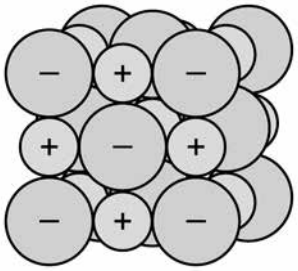
B



C



D



Tick ONE box.

☐ **A**

☐ **B**

☐ **C**

☐ **D**

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0 1 . 7 **Copper is used in electrical wiring.**

Give ONE reason why. [1 mark]

_____

_____

_____

[Turn over]

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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**

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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**

10

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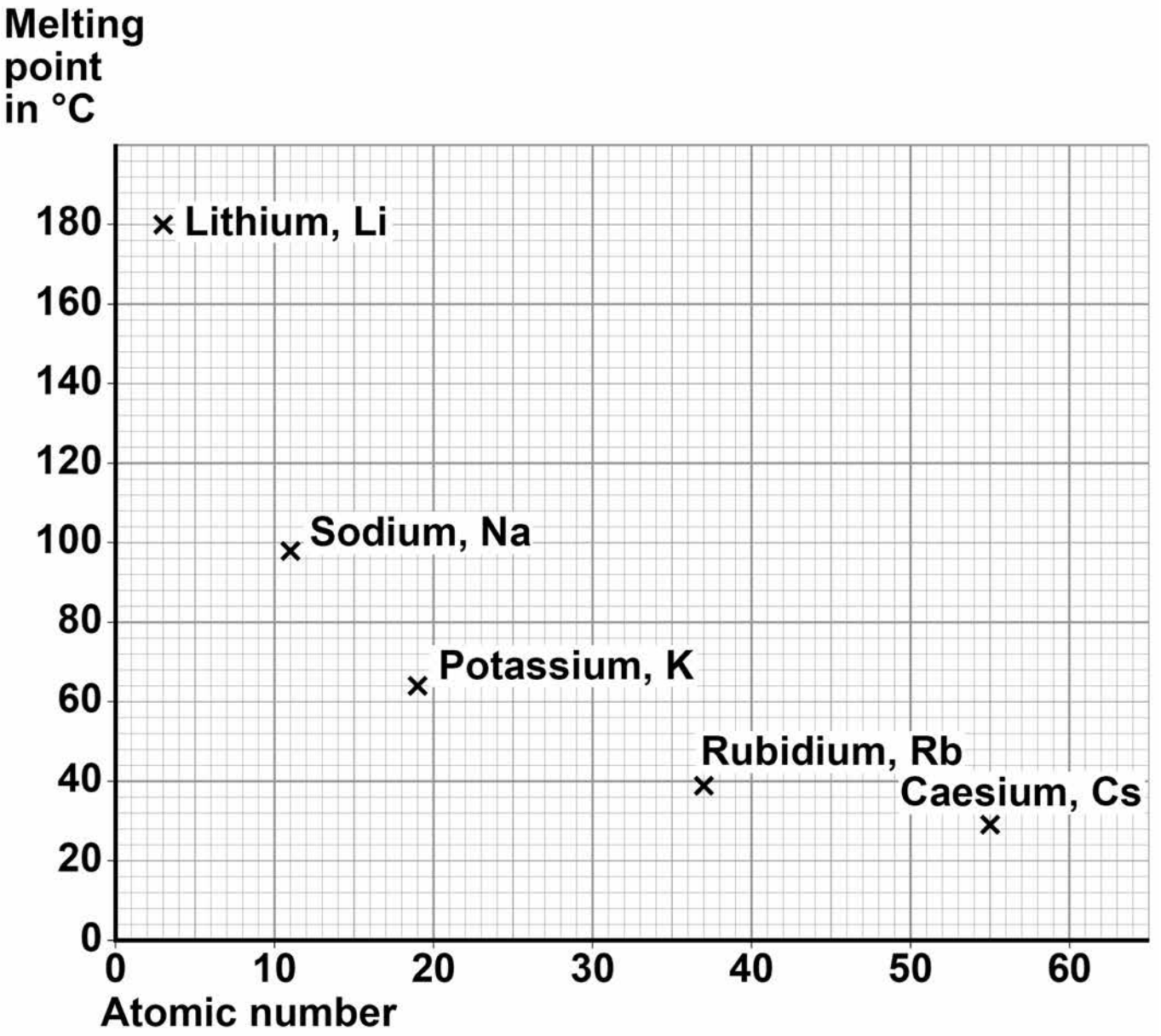
0 2 **This question is about Group 1 metals.**

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

FIGURE 1



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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]

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Lithium is a Group 1 metal.

0 2 . 3 A lithium atom can be shown as $^{7}_{3}Li$

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

Tick ONE box.

- ☐ 1
- ☐ 3
- ☐ 4
- ☐ 7

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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
	compound
	element
Lithium oxide	
	metal
Oxygen	
	mixture
	polymer

[Turn over]

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

_____ $Li + O_2 \rightarrow 2Li_2O$

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

Tick ONE box.

☐ **Covalent**

☐ **Ionic**

☐ **Metallic**

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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 = _____

9

[Turn over]

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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]**

_____

_____

_____

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0 3 . 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]

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0 3 . 4 The braking distance of the car was 14.0 m

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

Stopping distance = _____ m

0 3 . 5 What is the link between speed and braking distance?

Complete the sentence. [1 mark]

The greater the speed, the _____

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0 3 . 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

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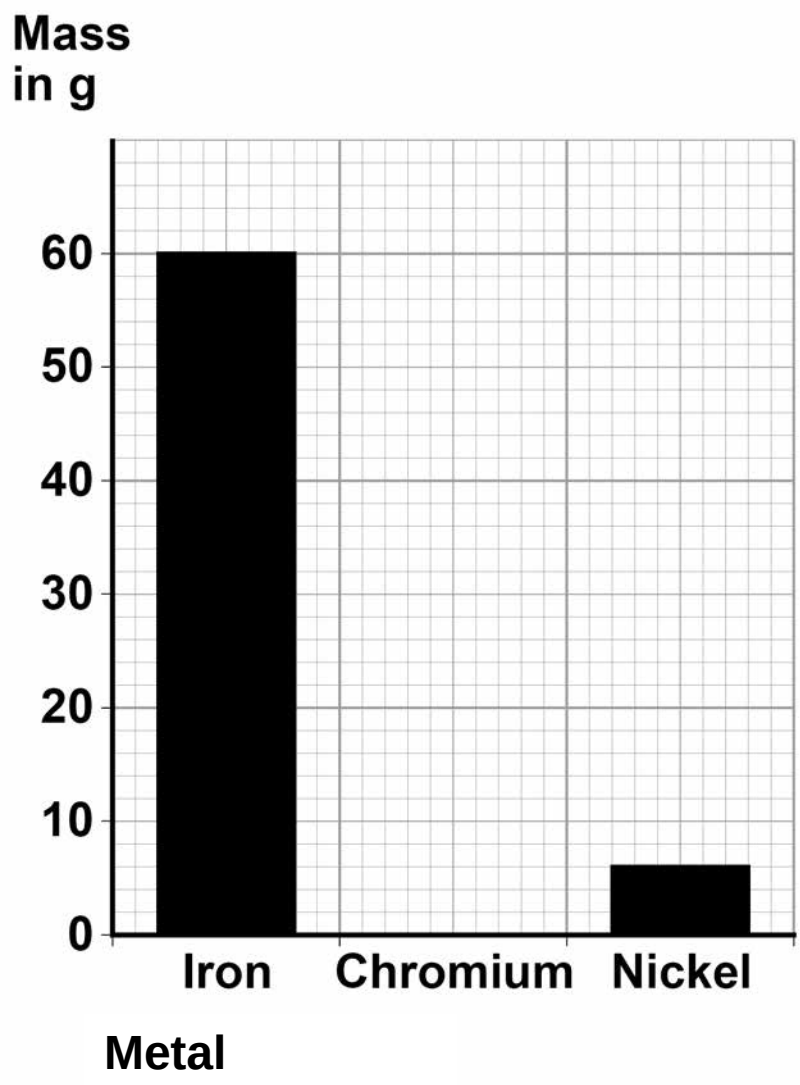
0 4 One alloy contains iron, chromium and nickel.

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

FIGURE 2



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0 4 . 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

0 4 . 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]

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0 4 . 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

0 4 . 4 What is an alloy? [1 mark]

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0 4 . 5 Give ONE reason why alloys are used instead of pure metals. [1 mark]

_____

_____

_____

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

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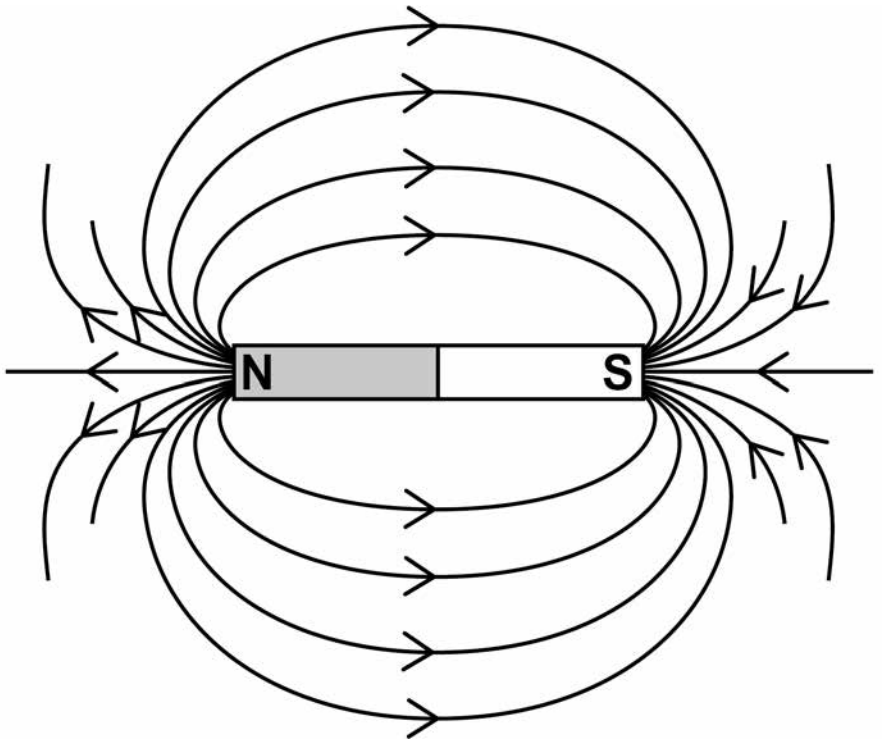
A student plotted the magnetic field pattern around a bar magnet.

FIGURE 3 shows the magnetic field pattern.

FIGURE 3



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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]

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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]

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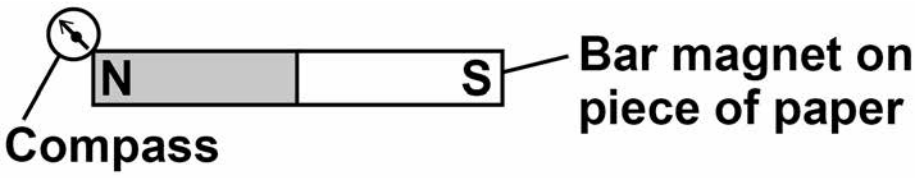
0 4 . 9 **This is the start of a method used to plot a magnetic field pattern around a bar magnet.**

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]

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0 5 **A student investigated the rate of reaction of magnesium with dilute hydrochloric acid.**

This is the method used.

1. **Add 50 cm^3 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 36, shows the student's results.

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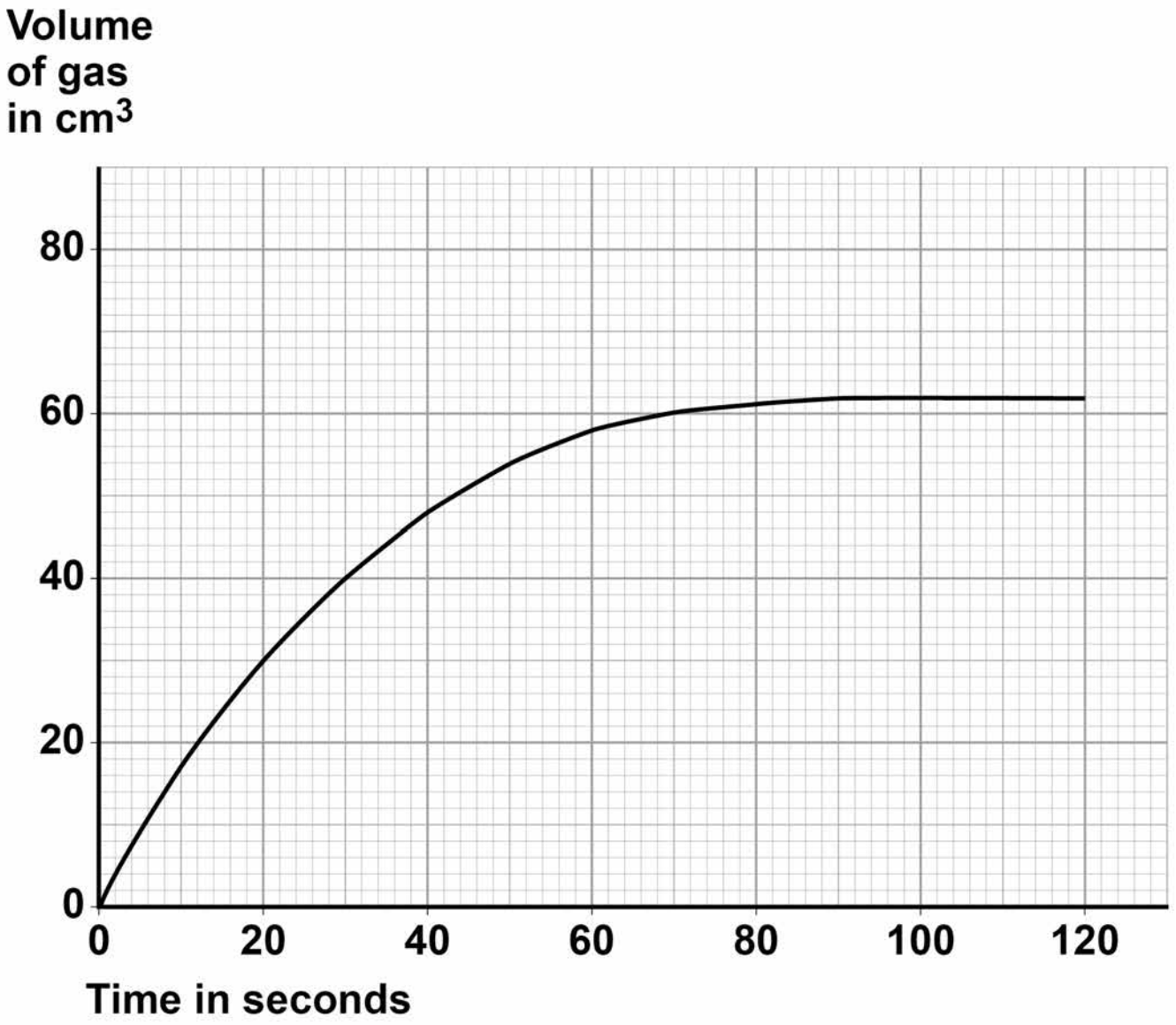
FIGURE 5



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

Use FIGURE 5 and the equation:

$$\text{mean rate of reaction} = \frac{\text{volume of gas produced after 10 seconds}}{\text{time taken}}$$

[2 marks]

Mean rate of reaction = _____

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0 5 . 2 **What is the unit for the mean rate of the reaction calculated in Question 05.1?**
[1 mark]

Tick ONE box.

- ☐ cm^3/s
- ☐ g/s
- ☐ s/cm^3
- ☐ s/g

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

Use FIGURE 5, on page 36. [2 marks]

1 _____

_____

_____

2 _____

_____

_____

[Turn over]

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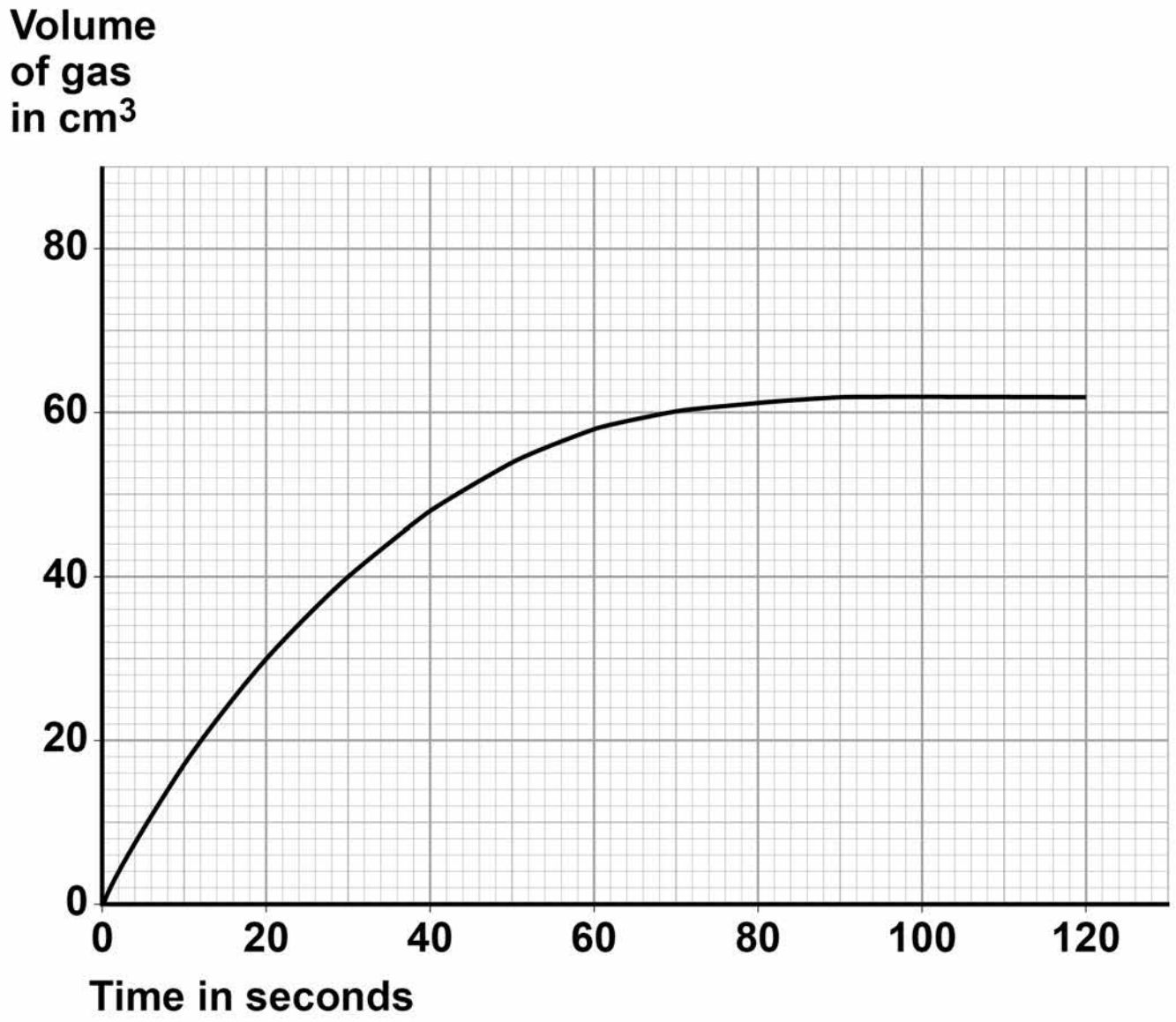
Repeat of FIGURE 5



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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 40, to show the expected results for the experiment using magnesium powder. [2 marks]

8

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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 cm^3 of sodium hydroxide solution to a polystyrene cup.**
2. **Measure the temperature of the sodium hydroxide solution.**
3. **Add 25.0 cm^3 of hydrochloric acid to the sodium hydroxide solution.**
4. **Stir the solution.**
5. **Measure the maximum temperature of the solution.**

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0 6 . 1 **Draw ONE line from each measurement to the most suitable piece of equipment to use to make the measurement. [2 marks]**

MEASUREMENT	EQUIPMENT
	balance
	beaker
Temperature of solution	
	measuring cylinder
Volume of hydrochloric acid	
	metre rule
	thermometer

[Turn over]

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0 6 . 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]

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Mean maximum temperature rise =

_____ °C

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

Tick ONE box.

☐ Add 20.0 cm^3 of hydrochloric acid

☐ Use a lid on the polystyrene cup

☐ Use a metal beaker

☐ Use a thermometer with a resolution of 1 °C

[Turn over]

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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

$\rightarrow$ _____ + _____

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0 6 . 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
	green
	orange
1	
	purple
13	
	red
	yellow

9

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0 7 An athlete trains to improve his fitness by walking, cycling and running.

0 7 . 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

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0 7 . 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]

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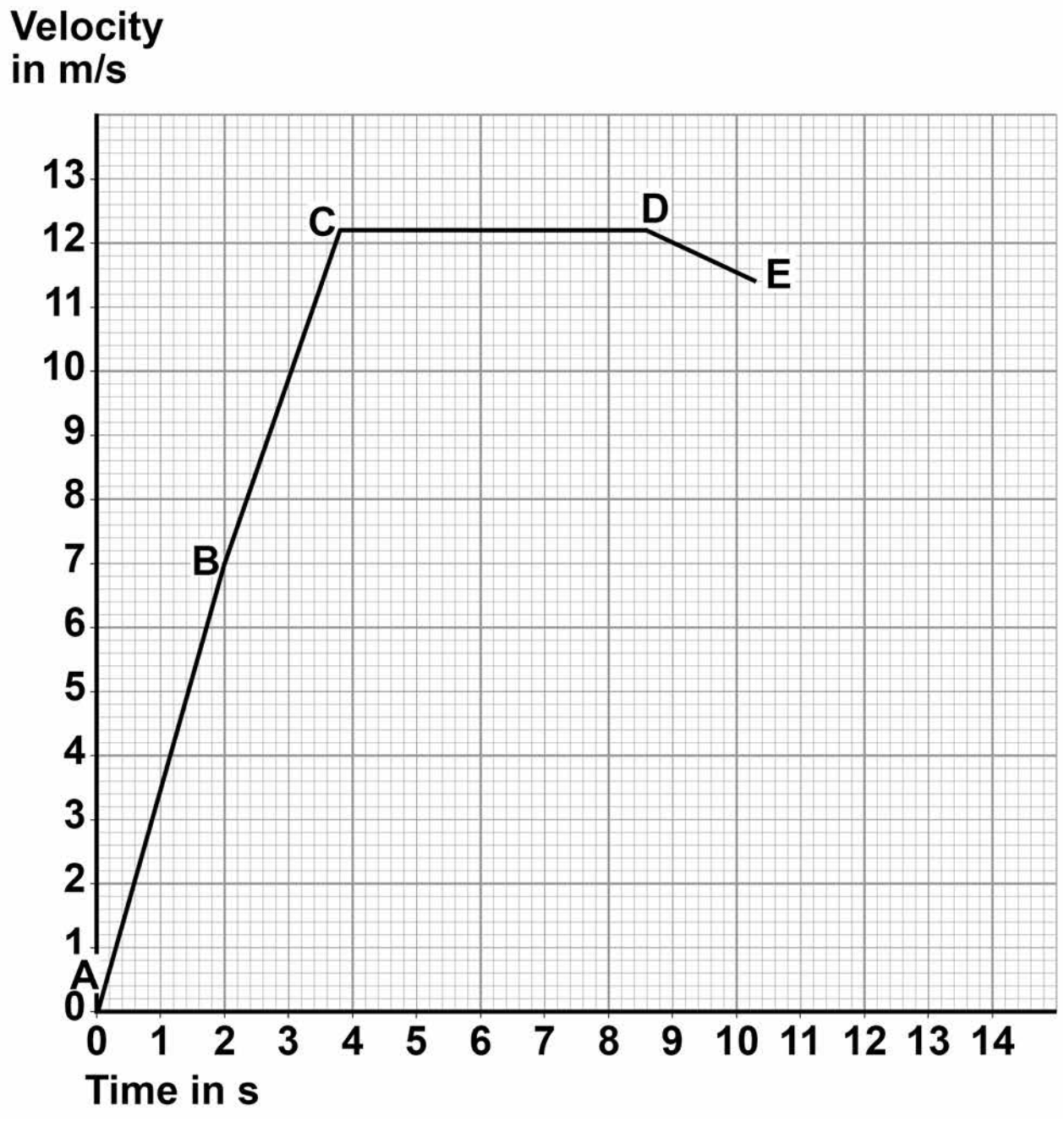
The athlete takes part in a race on a straight, horizontal running track.

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

FIGURE 6



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0 7 . 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

0 7 . 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, on page 50, to show the motion of the athlete after point E. [2 marks]

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0 7 . 5 **Which section of the graph in FIGURE 6, on page 50, shows the athlete moving at constant velocity? [1 mark]**

Tick ONE box.

☐ **A–B**

☐ **B–C**

☐ **C–D**

☐ **D–E**

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0 7 . 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]

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0 7 . 7 **What does the area under a velocity-time graph represent? [1 mark]**

Tick ONE box.

- ☐ **Acceleration**
- ☐ **Distance travelled**
- ☐ **Energy**
- ☐ **Speed**

0 7 . 8 **Write the equation which links acceleration, mass and resultant force. [1 mark]**

_____

_____

_____

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0 7 . 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/s^2

12

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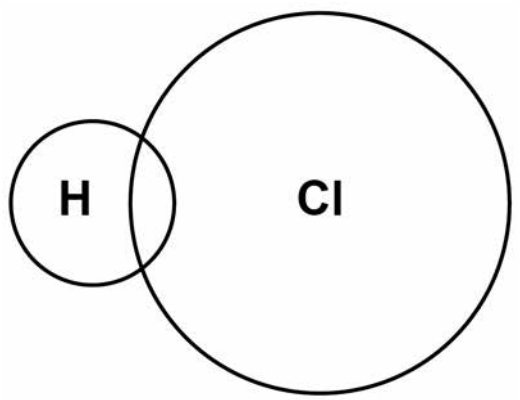
0 8 This question is about hydrogen chloride.

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]

H_2 + _____ → _____

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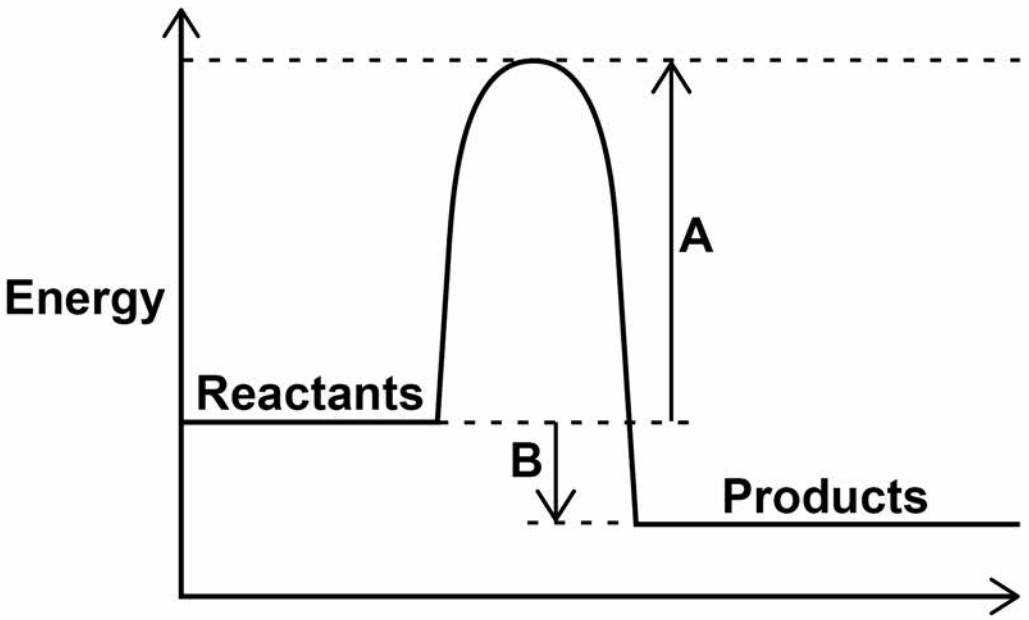
FIGURE 8 shows the reaction profile diagram for the reaction between hydrogen and chlorine.

FIGURE 8



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

A _____

_____

B _____

_____

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

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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]

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]

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0 9 . 2 **Describe how to make pure dry crystals of magnesium chloride from magnesium carbonate and a dilute acid.**

In your method you should name the apparatus and reagents you plan to use.
[6 marks]

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[Turn over]

8

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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]

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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]

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1 0 . 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]

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1 0 . 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

[Turn over]

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1 0 . 6 **Describe the environmental advantages and disadvantages of using wind turbines to generate electricity in the UK. [4 marks]**

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12

END OF QUESTIONS

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There are no questions printed on this page

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Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
TOTAL	

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