A

AQA

Surname _____

Other Names _____

Centre Number _____

Candidate Number _____

Candidate Signature _____

GCSE
CHEMISTRY

F

Foundation Tier Paper 2

8462/2F

Wednesday 13 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]

JUN188462 2F 01

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

- **There are 100 marks available on this paper.**
- **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 copper sulfate.**

Blue copper sulfate turns white when it is heated.

The word equation for the reaction is:

hydrated copper sulfate	⇌	**anhydrous copper sulfate**	**+**	**water**
blue		**white**		

0 1 . 1 What name is given to hydrated copper sulfate in this reaction?

Tick ONE box. [1 mark]

- ☐ **Catalyst**
- ☐ **Element**
- ☐ **Product**
- ☐ **Reactant**

[Turn over]

0 1 . 2 What does the symbol ⇌ mean?

Tick ONE box. [1 mark]

☐ **Endothermic**

☐ **Exothermic**

☐ **Reversible**

☐ **Polymerisation**

0 1 . 3 Complete the sentence. [1 mark]

The colour change when water is added to anhydrous copper sulfate is white to _____ .

A student heats 2.5 g of hydrated copper sulfate in a test tube.

0.9 g of water is given off.

The remaining solid is anhydrous copper sulfate.

0 1 . 4 Calculate the mass of anhydrous copper sulfate produced.
[1 mark]

Mass of anhydrous copper sulfate = _____ g

0 1 . 5 **Calculate the percentage of water contained in 2.5 g of hydrated copper sulfate. [2 marks]**

Percentage of water = _____ %

0 1 . 6 **Draw ONE line from each compound to the formula for the compound. [2 marks]**

Compound	Formula for the compound
Copper sulfate	CuO
	CuS
	$CuSO_4$
Water	H_2O
	H_2SO_4

8

0 2 **This question is about fuels.**

Octane (C_8H_{18}) is a hydrocarbon in petrol.

0 2 . 1 **Cracking breaks down large hydrocarbon molecules into smaller hydrocarbon molecules.**

Which hydrocarbon molecule can be cracked to produce octane, C_8H_{18}?

Tick ONE box. [1 mark]

- ☐ **C_4H_8**
- ☐ **C_4H_{10}**
- ☐ **C_8H_{16}**
- ☐ **$C_{12}H_{26}$**

0 2 . 2 **What type of carbon compound is octane, C_8H_{18} ?**

Tick ONE box. [1 mark]

☐ **Alcohol**

☐ **Alkane**

☐ **Carboxylic acid**

☐ **Ester**

0 2 . 3 **Oxygen is needed to burn fuels.**

Name the source of the oxygen needed to burn fuels. [1 mark]

0 2 . 4 **Particulates and sulfur dioxide are pollutants produced when some fuels burn.**

Draw ONE line from each pollutant to the polluting effect.
[2 marks]

Pollutant	Polluting effect
	Acid rain
Particulates	Global dimming
	Global warming
Sulfur dioxide	Landfill
	Sewage sludge

0 2 . 5 **Which TWO gases are produced when fuels burn in car engines?**

Tick TWO boxes. [2 marks]

- ☐ **Ammonia**
- ☐ **Carbon dioxide**
- ☐ **Carbon monoxide**
- ☐ **Nitrogen**
- ☐ **Oxygen**

[Turn over]

0 2 . 6 **Vehicles produce most of the atmospheric pollution in cities.**

How could the atmospheric pollution in cities be reduced?

Tick TWO boxes. [2 marks]

- ☐ **Build more roads in cities**
- ☐ **Build new car factories**
- ☐ **Develop fuel efficient engines**
- ☐ **Make car tax cheaper**
- ☐ **Use electric cars**

9

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[Turn over]

0 3 **Polymers are used to make fabrics.**

TABLE 1 shows some properties of two polymers.

TABLE 1

Property	Polymer J	Polymer K
Density in g/cm^3	0.9	1.4
Melting point in °C	165	260
Flame resistance	Poor	Good
Water absorption	Low	High

0 3 . 1 **Polymer fabrics are used to make firefighter uniforms.**

Complete TABLE 2 by deciding for each property whether polymer J or polymer K is BEST for firefighter uniforms.

Use TABLE 1, on page 16.

Density has been completed for you.

Tick THREE boxes. [2 marks]

TABLE 2

Property	Polymer J	Polymer K
Density in g/cm^3	✓	
Melting point in °C		
Flame resistance		
Water absorption		

[Turn over]

Repeat of TABLE 1

Property	Polymer J	Polymer K
Density in g/cm^3	0.9	1.4
Melting point in °C	165	260
Flame resistance	Poor	Good
Water absorption	Low	High

0 3 . 2 **A firefighter uniform made from polymer J has a mass of 6.0 kg**

Calculate the mass of a uniform of the same size made from polymer K.

Use TABLE 1 and the equation:

$$\text{mass of uniform made from polymer K} = \frac{\text{density of polymer K}}{\text{density of polymer J}} \times 6.0$$

[2 marks]

Mass of uniform made from polymer K =

_____ **kg**

[Turn over]

0 3 . 3 **Polymers J and K are both thermosoftening polymers.**

Polymer L is a thermosetting polymer.

Why would polymer L be better than polymers J and K for firefighter uniforms?

Tick ONE box. [1 mark]

☐ **Polymer L burns easily**

☐ **Polymer L does not biodegrade**

☐ **Polymer L will not melt**

Polymers J and K are made from crude oil.

In the past, firefighter uniforms were made from wool.

Wool is obtained from sheep.

0 3 . 4 Why are many fabrics made from polymers instead of wool?

Tick ONE box. [1 mark]

- ☐ **Polymers are man-made**
- ☐ **Polymers are more hard-wearing**
- ☐ **Wool is more easily available**
- ☐ **Wool is more flame resistant**

[Turn over]

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0 3 . 5 **Why is wool more sustainable than polymers J and K for making firefighter uniforms?**
[2 marks]

8

0 4 **A 9 carat gold ring is made from a mixture of metals.**

TABLE 3 shows the mass of different metals in the ring.

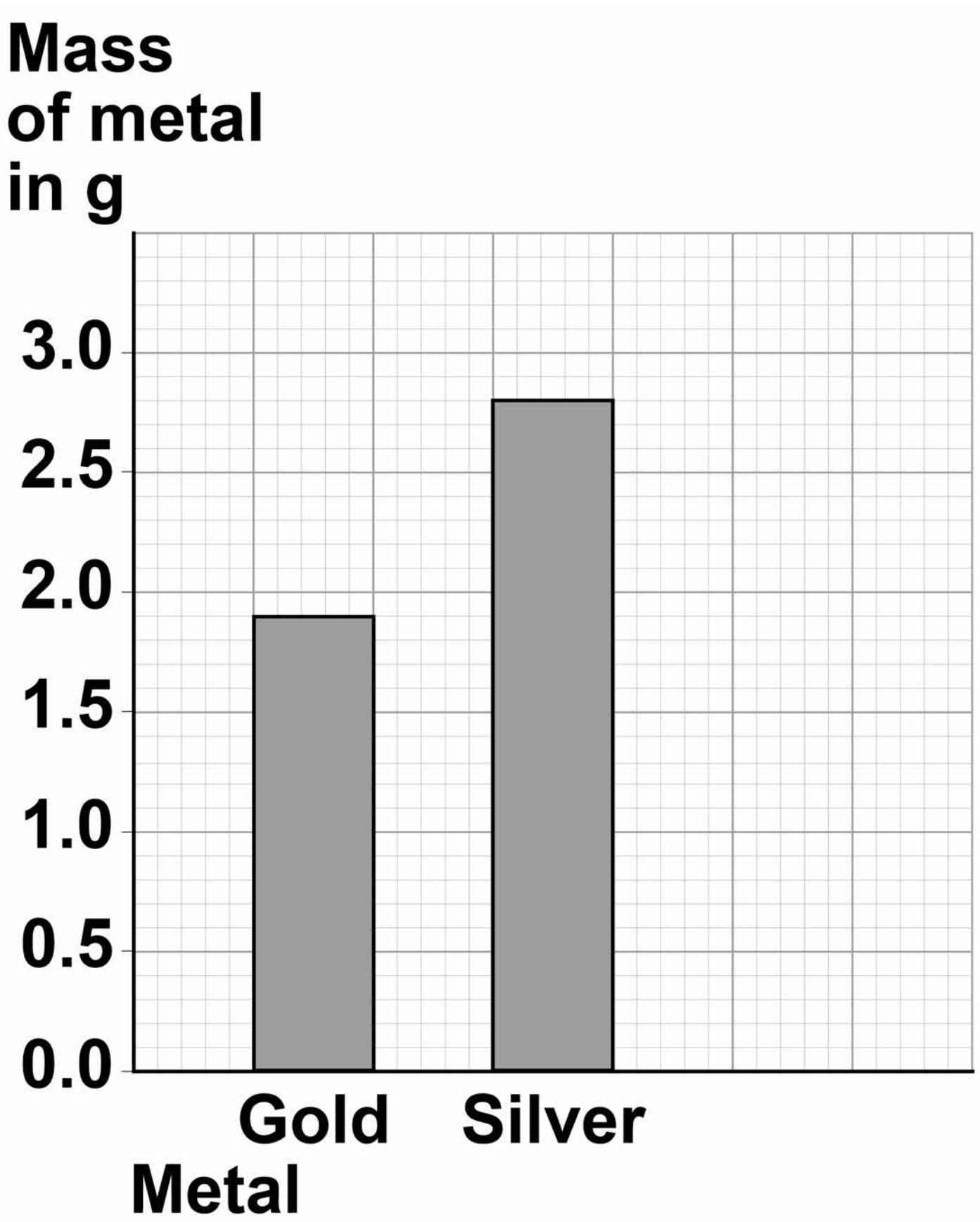
The mass of the ring is 5.0 g

TABLE 3

Metal	Mass of metal in g
Gold	1.9
Silver	2.8
Copper	0.3

0 4 . 1 **Plot the data for copper from TABLE 3 on FIGURE 1. [2 marks]**

FIGURE 1



[Turn over]

Repeat of TABLE 3

Metal	Mass of metal in g
Gold	1.9
Silver	2.8
Copper	0.3

0 4 . 2 The cost of gold is £30 per gram.

Calculate the cost of the gold used in the 9 carat gold ring.

Use TABLE 3. [1 mark]

Cost of gold = £ _____

0 4 . 3 **Rings can be made from 22 carat gold.**

The ratio of the mass of gold in 22 carat gold compared to 9 carat gold is 22 : 9

Calculate the mass of gold in a 22 carat gold ring of mass 5.0 g

Use TABLE 3. [2 marks]

_____

_____

_____

Mass of gold = _____ g

[Turn over]

0 4 . 4 **Pure gold is 24 carat.**

Suggest TWO reasons why silver and copper are mixed with gold to make 9 carat gold rings. [2 marks]

1

2

0 4 . 5 **Copper is obtained from copper ores or by recycling copper.**

- **Copper ores are non-renewable.**
- **Copper ores can be obtained by mining.**
- **Some scrap copper goes to landfill sites.**

Give THREE reasons why we should use recycled copper instead of copper from copper ores. [3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

10

0 5 **A student investigated the colours in three different flowers, A, B and C, using paper chromatography.**

The colours are soluble in ethanol but are insoluble in water.

This is the method used.

1. **Place ethanol in a beaker.**
2. **Add the flower.**
3. **Stir until the colours dissolve in the ethanol.**
4. **Filter the mixture.**
5. **Put spots of the coloured filtrate on the chromatography paper.**

0 5 . 1 **The filtrate was a very pale coloured solution.**

How could the student obtain a darker coloured solution?

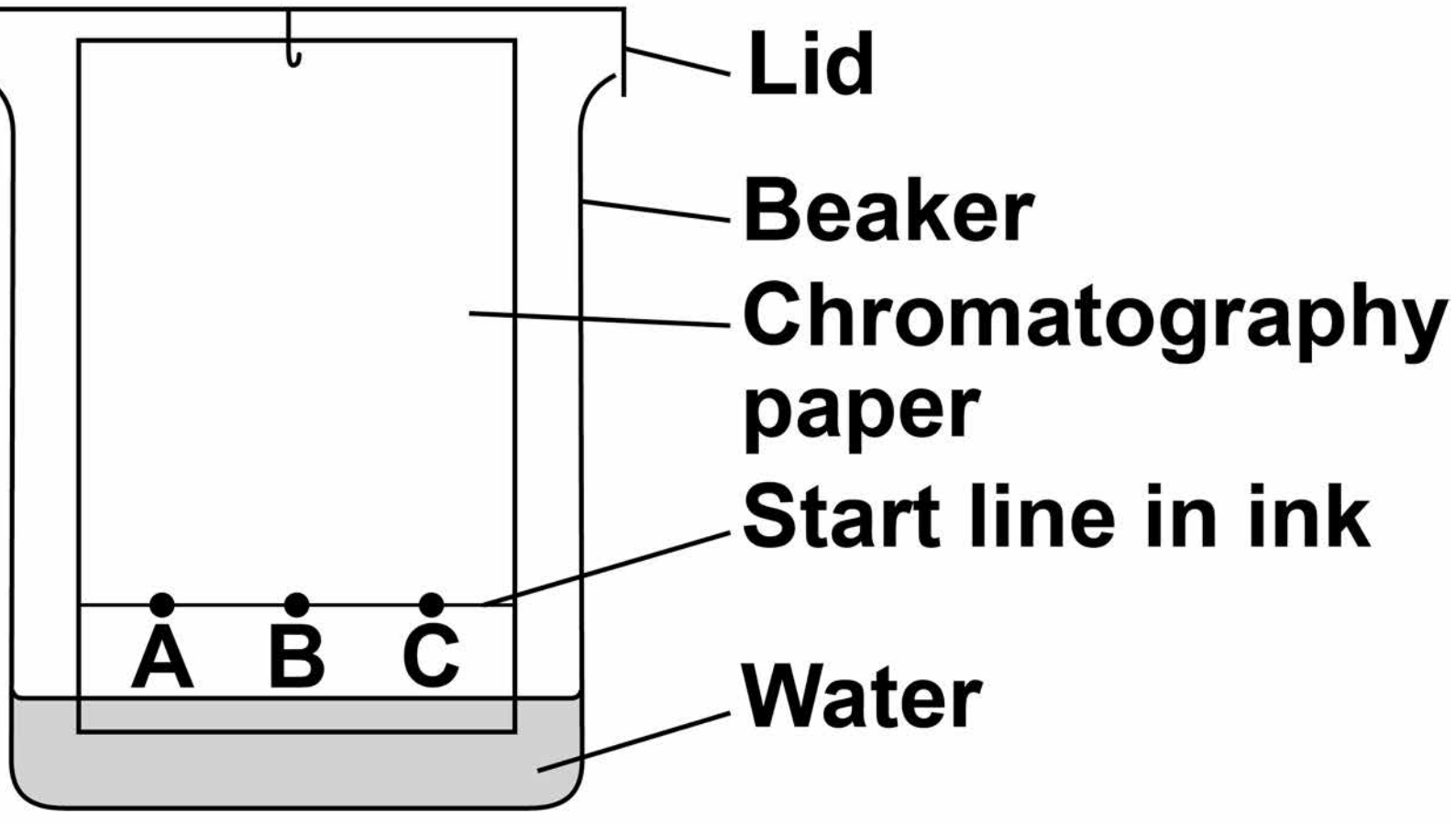
Tick TWO boxes. [2 marks]

- ☐ **Crush the flower**
- ☐ **Filter the mixture three times**
- ☐ **Use a larger beaker**
- ☐ **Use more ethanol**
- ☐ **Use more flowers**

[Turn over]

0 5 . 2 **FIGURE 2 shows the apparatus used.**

FIGURE 2



What TWO mistakes did the student make in setting up the apparatus?

Tick TWO boxes. [2 marks]

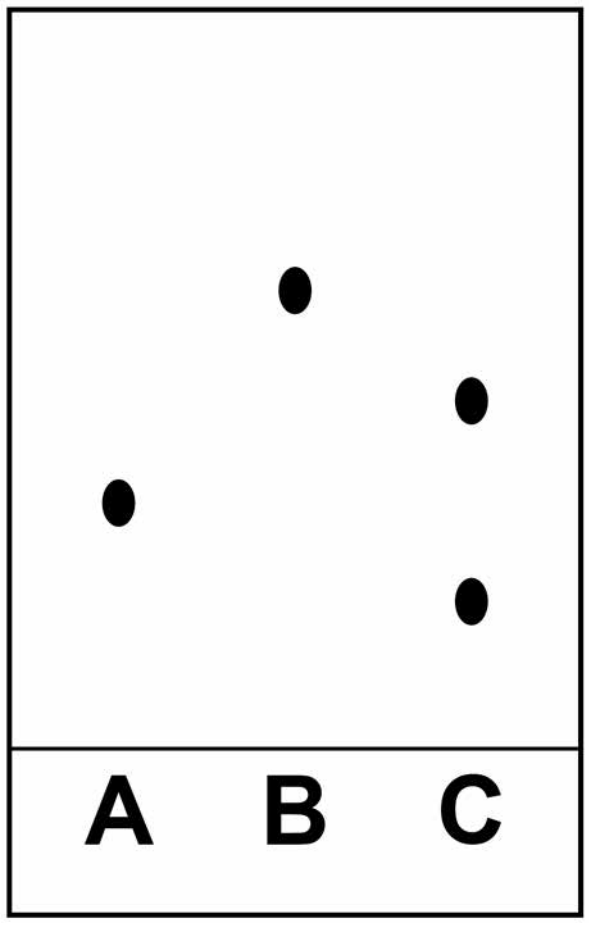
- ☐ The paper does not touch the beaker
- ☐ The start line is drawn in ink
- ☐ The water level is below the start line
- ☐ Uses a lid on the beaker
- ☐ Uses water as the solvent

[Turn over]

0 5 . 3 **Another student sets up the apparatus correctly.**

FIGURE 3 represents the student's results.

FIGURE 3



What TWO conclusions can be made from FIGURE 3?

Tick TWO boxes. [2 marks]

- ☐ **Flower A contains a single pure colour**
- ☐ **Flowers A and B contain the same colours**
- ☐ **The colour in flower C is a mixture**
- ☐ **The colour in flower B was the least soluble**
- ☐ **Two of the colours have the same R_f value**

[Turn over]

0 5 . 4 **The student records some measurements.**

The measurements are:

- **the colour from flower B moves 7.2 cm**
- **the solvent moves 9.0 cm**

Calculate the R_f value for the colour from flower B.

Use the equation:

$$R_f = \frac{\text{distance moved by colour}}{\text{distance moved by solvent}}$$

[2 marks]

Rf value = _____

8

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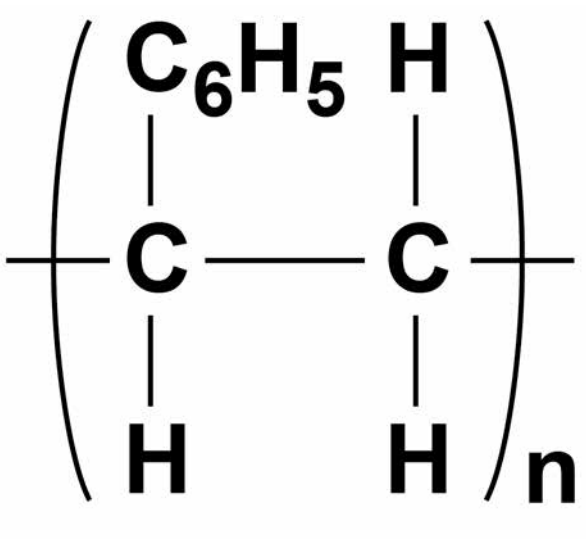
[Turn over]

0 6 **Disposable cups are made from coated paper or poly(styrene).**

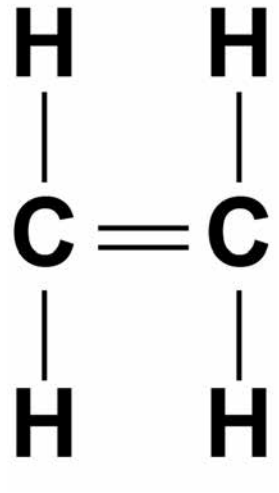
FIGURE 4 represents the structure of poly(styrene).

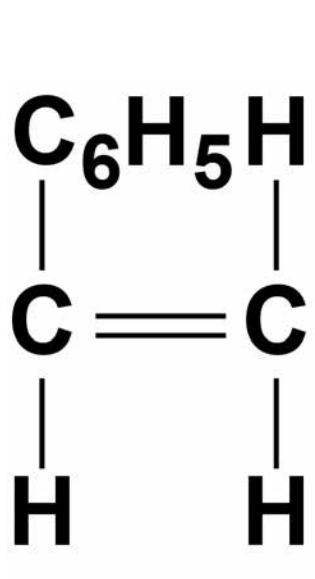
FIGURE 4

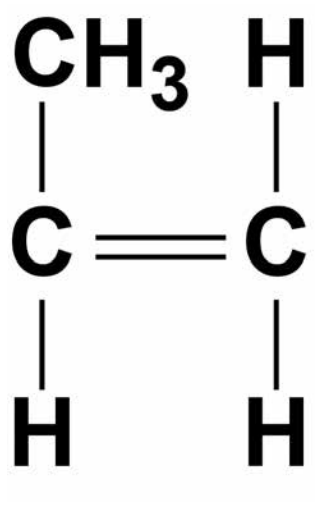


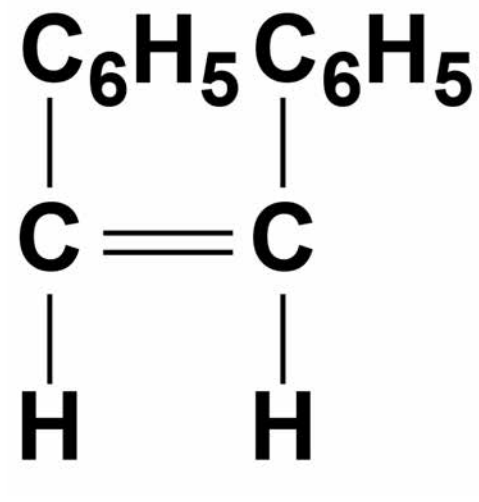
0 6 . 1 **Which small molecule is used to produce poly(styrene)?**

Tick ONE box. [1 mark]

☐ 

☐ 

☐ 

☐ 

0 6 . 2 Which process is used to make poly(styrene) from small molecules?

Tick ONE box. [1 mark]

- ☐ **Cracking**
- ☐ **Distillation**
- ☐ **Fermentation**
- ☐ **Polymerisation**

0 6 . 3 **Complete the sentences.**

Choose answers from the list below. [3 marks]

- **ceramics**
- **composites**
- **four**
- **many**
- **monomers**
- **polymers**
- **two**

Poly(styrene) is produced from small molecules called

_____ .

When poly(styrene) is made,

_____ styrene molecules join to form large molecules.

These large molecules are called

_____ .

0 6 . 4 **TABLE 4 gives some information about disposable cups.**

TABLE 4

	Coated paper cups	Poly(styrene) cups
Source of raw materials	Wood	Crude oil
Energy to make 1 cup in arbitrary units	550	200
Biodegradable	Yes	No
Recyclable	No	Yes

Compare the advantages and disadvantages of using coated paper and poly(styrene) to make disposable cups.

Use TABLE 4 and your knowledge and understanding of life cycle assessments (LCAs).
[4 marks]

[Turn over]

9

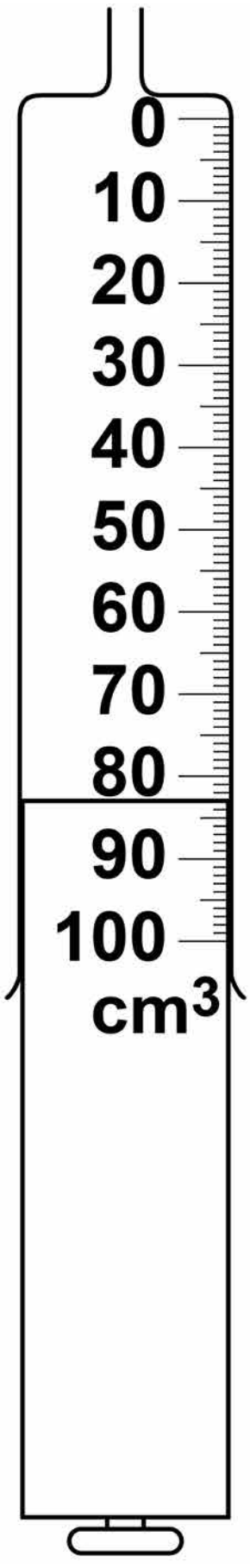
0 7 **A student investigated how concentration affects the rate of reaction between magnesium and hydrochloric acid.**

This is the method used.

1. **Place hydrochloric acid in a conical flask.**
2. **Add magnesium powder.**
3. **Collect the gas produced in a gas syringe.**
4. **Measure the volume of gas every 40 seconds for 160 seconds.**
5. **Repeat steps 1–4 three more times.**
6. **Repeat steps 1–5 with hydrochloric acid of a higher concentration.**

0 7 . 1 **FIGURE 5 shows a gas syringe.**

FIGURE 5



What is the volume of gas in the syringe? [1 mark]

Volume = _____ cm^3

[Turn over]

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0 7 . 2 **Which TWO variables should the student keep the same to make the investigation a fair test?**

Tick TWO boxes. [2 marks]

- ☐ **Concentration of hydrochloric acid**
- ☐ **Mass of magnesium powder**
- ☐ **Temperature of hydrochloric acid**
- ☐ **Time for reaction to end**
- ☐ **Volume of gas collected**

[Turn over]

TABLE 5 shows the student's results for the experiment with hydrochloric acid of a lower concentration.

TABLE 5

Time in seconds	Volume of gas collected in cm^3				
	Test 1	Test 2	Test 3	Test 4	Mean
0	0	0	0	0	0
40	46	30	47	49	X
80	78	83	83	82	82
120	98	94	96	95	96
160	100	100	100	100	100

0 7 . 3 **Calculate mean value X in TABLE 5.**

Do NOT include the anomalous result in your calculation.

Give your answer to 2 significant figures. [2 marks]

_____

_____

_____

_____

X = _____ **cm^3**

Repeat of TABLE 5

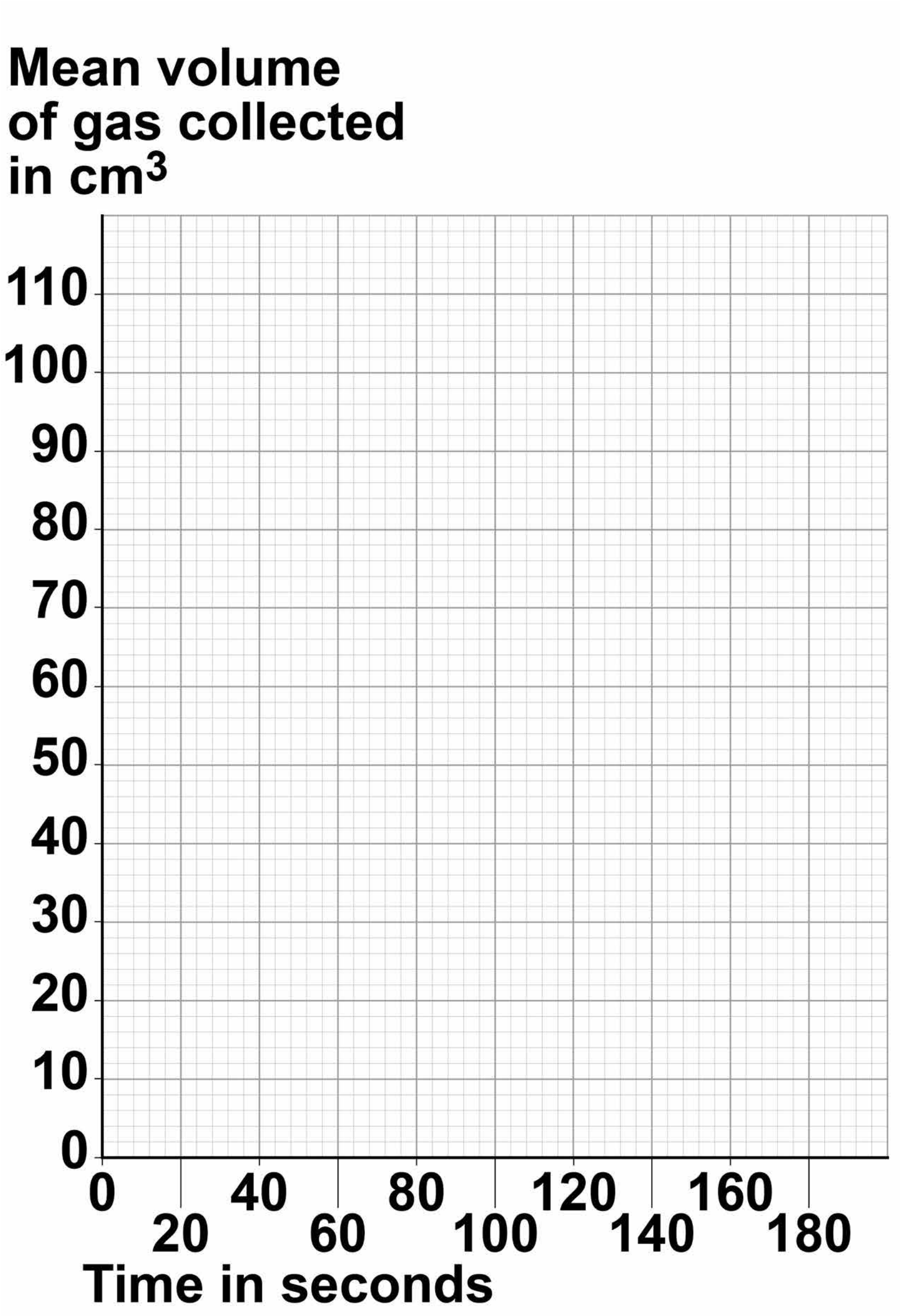
Time in seconds	Volume of gas collected in cm^3				
	Test 1	Test 2	Test 3	Test 4	Mean
0	0	0	0	0	0
40	46	30	47	49	X
80	78	83	83	82	82
120	98	94	96	95	96
160	100	100	100	100	100

0 7 . 4 Plot the data from TABLE 5 on FIGURE 6.

You should include your answer to Question 07.3.

You do NOT need to draw a line of best fit. [2 marks]

FIGURE 6



[Turn over]

FIGURE 7, on page 54, shows results of the experiment with the hydrochloric acid of a higher concentration.

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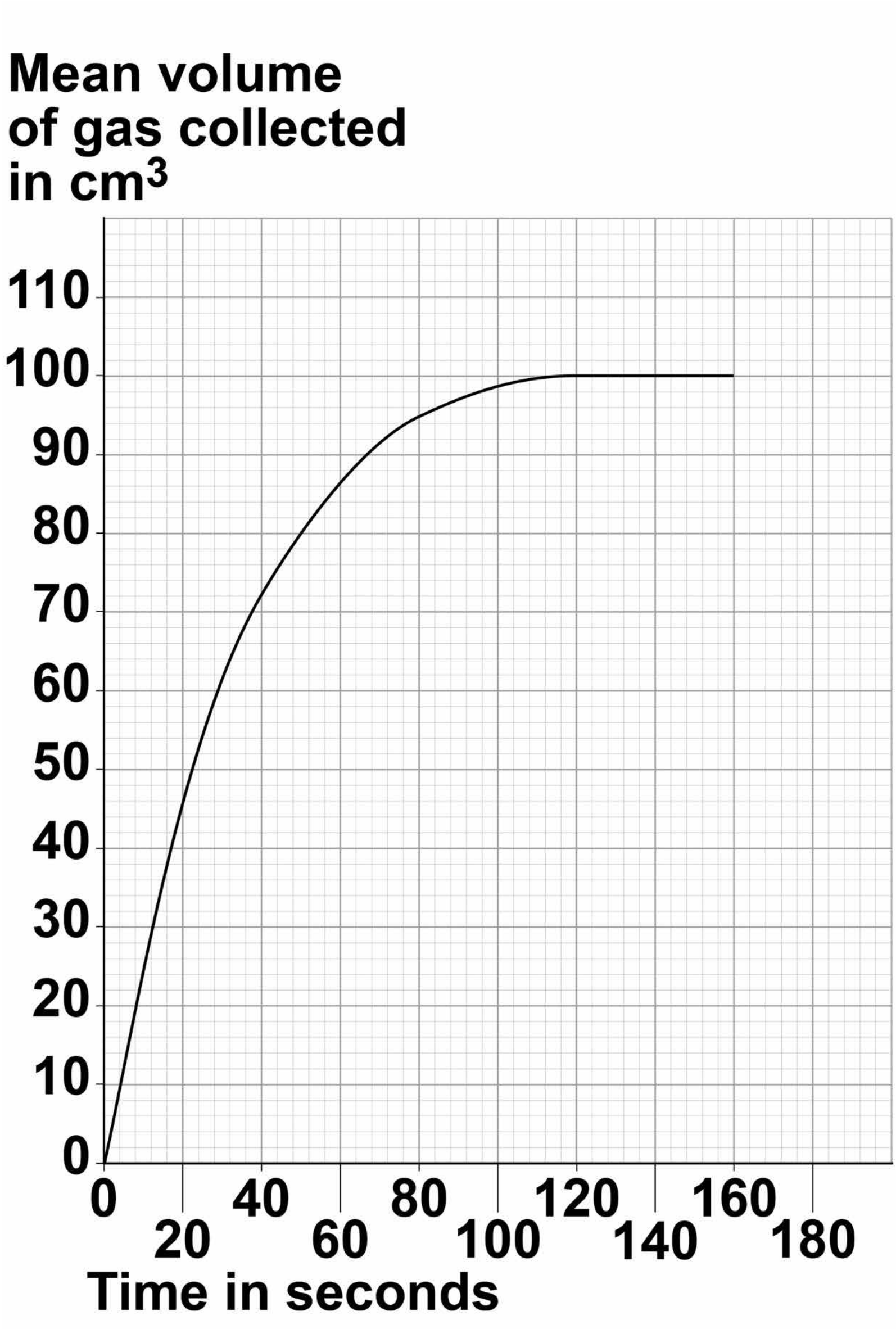
[Turn over]

FIGURE 7


Mean volume of gas collected in cm3
110
100
90
80
70
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
Time in seconds

0 7 . 5 **Calculate the mean rate of reaction between 0 and 50 seconds.**

Use FIGURE 7 and the equation:

$$\text{mean rate of reaction} = \frac{\text{mean volume of gas collected}}{\text{time taken}}$$

[2 marks]

Mean rate of reaction = _____ cm^3/s

Repeat of FIGURE 7

0 7 . 6 **Describe how the RATE OF REACTION changes between 0 and 160 seconds.**

Use FIGURE 7. [3 marks]

0 7 . 7 **The student concludes that the rate of reaction is greater when the concentration of hydrochloric acid is higher.**

Why is the rate of reaction greater when the concentration of hydrochloric acid is higher?

Tick TWO boxes. [2 marks]

- ☐ **The particles are moving faster**
- ☐ **The particles have more energy**
- ☐ **The surface area of magnesium is smaller**
- ☐ **There are more particle collisions each second**
- ☐ **There are more particles in the same volume**

0 7 . 8 **The student tests the gas produced by bubbling it through limewater.**

No change is seen in the limewater.

Give ONE conclusion the student can make about the gas. [1 mark]

_____

_____

_____

[Turn over]

0 7 . 9 **The student tests the gas produced using a burning splint.**

Name the gas the student is testing for.

Give the result of a positive test for this gas. [2 marks]

Name of gas _____

_____

Result _____

_____

_____

17

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[Turn over]

0 8 **This question is about chemicals in fireworks.**

Coloured flames are produced because of the metal ions in the fireworks.

0 8 . 1 **What colour flame would sodium ions produce? [1 mark]**

0 8 . 2 **Name a metal ion that would produce a green flame. [1 mark]**

0 8 . 3 **Some fireworks contain a mixture of metal ions.**

Why is it difficult to identify the metal ions from the colour of the flame? [1 mark]

_____

_____

_____

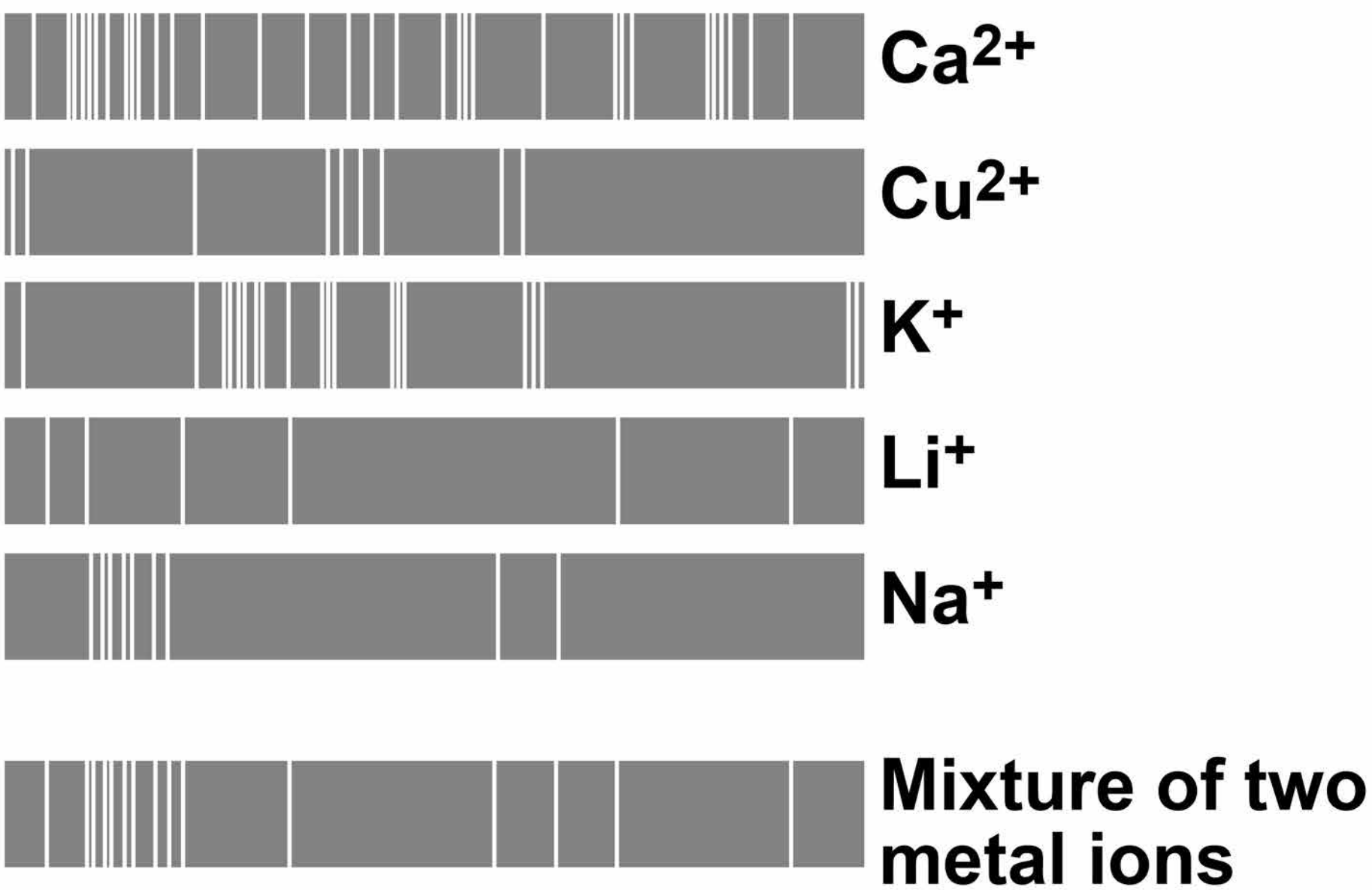
[Turn over]

0 8 . 4 **Flame emission spectroscopy is used to identify metal ions in a firework.**

FIGURE 8 shows:

- **the flame emission spectra of five individual metal ions**
- **a flame emission spectrum for a mixture of two metal ions.**

FIGURE 8



Which TWO metal ions are in the mixture?

Tick TWO boxes. [2 marks]

- ☐ Ca^{2+}
- ☐ Cu^{2+}
- ☐ K^{+}
- ☐ Li^{+}
- ☐ Na^{+}

[Turn over]

The compounds in fireworks also contain non-metal ions.

A scientist tests a solution of the chemicals used in a firework.

0 8 . 5 Silver nitrate solution and dilute nitric acid are added to the solution.

A cream precipitate forms.

Which ion is shown to be present by the cream precipitate? [1 mark]

0 8 . 6 **Describe a test to show the presence of sulfate ions in the solution.**

Give the result of the test if there are sulfate ions in the solution.
[3 marks]

Test

Result

[Turn over]

9

0 9 **Methylated spirit is a useful product made from a mixture of substances.**

TABLE 6 shows the mass of the substances in a sample of methylated spirit.

TABLE 6

Substance	Mass in grams
Ethanol	265.5
Methanol	23.3
Pyridine	3.0
Methyl violet	1.5

0 9 . 1 **What name is given to a useful product such as methylated spirit? [1 mark]**

0 9 . 2 **Calculate the percentage by mass of methanol in methylated spirit.**

Use TABLE 6. [2 marks]

Percentage = _____ %

Methylated spirit contains ethanol and is available cheaply.

Methylated spirit also contains:

- pyridine which has a very unpleasant smell
- methyl violet which makes the mixture purple.

0 9 . 3 Suggest why pyridine and methyl violet are added to ethanol to make methylated spirit. [1 mark]

0 9 . 4 Suggest ONE use of methylated spirit. [1 mark]

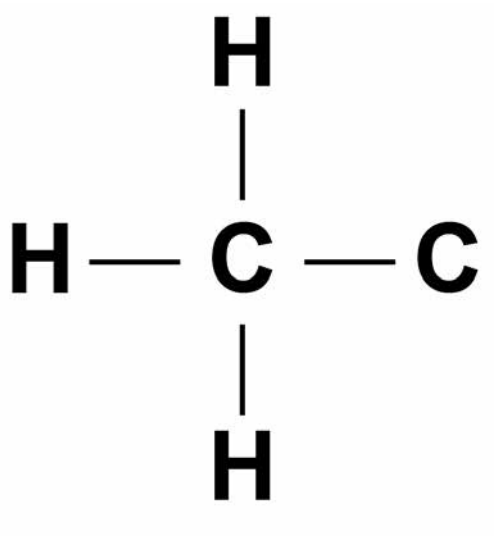
0 9 . 5 **Describe how ethanol is produced from sugar solution.**

Give the name of this process.
[3 marks]

0 9 . 6 **FIGURE 9 shows part of the displayed formula for ethanol.**

Complete FIGURE 9. [1 mark]

FIGURE 9



0 9 . 7 **Name the gas produced when sodium is added to ethanol. [1 mark]**

0 9 . 8 **Methanol is used to produce methanoic acid.**

What type of substance reacts with methanol to produce methanoic acid? [1 mark]

_____

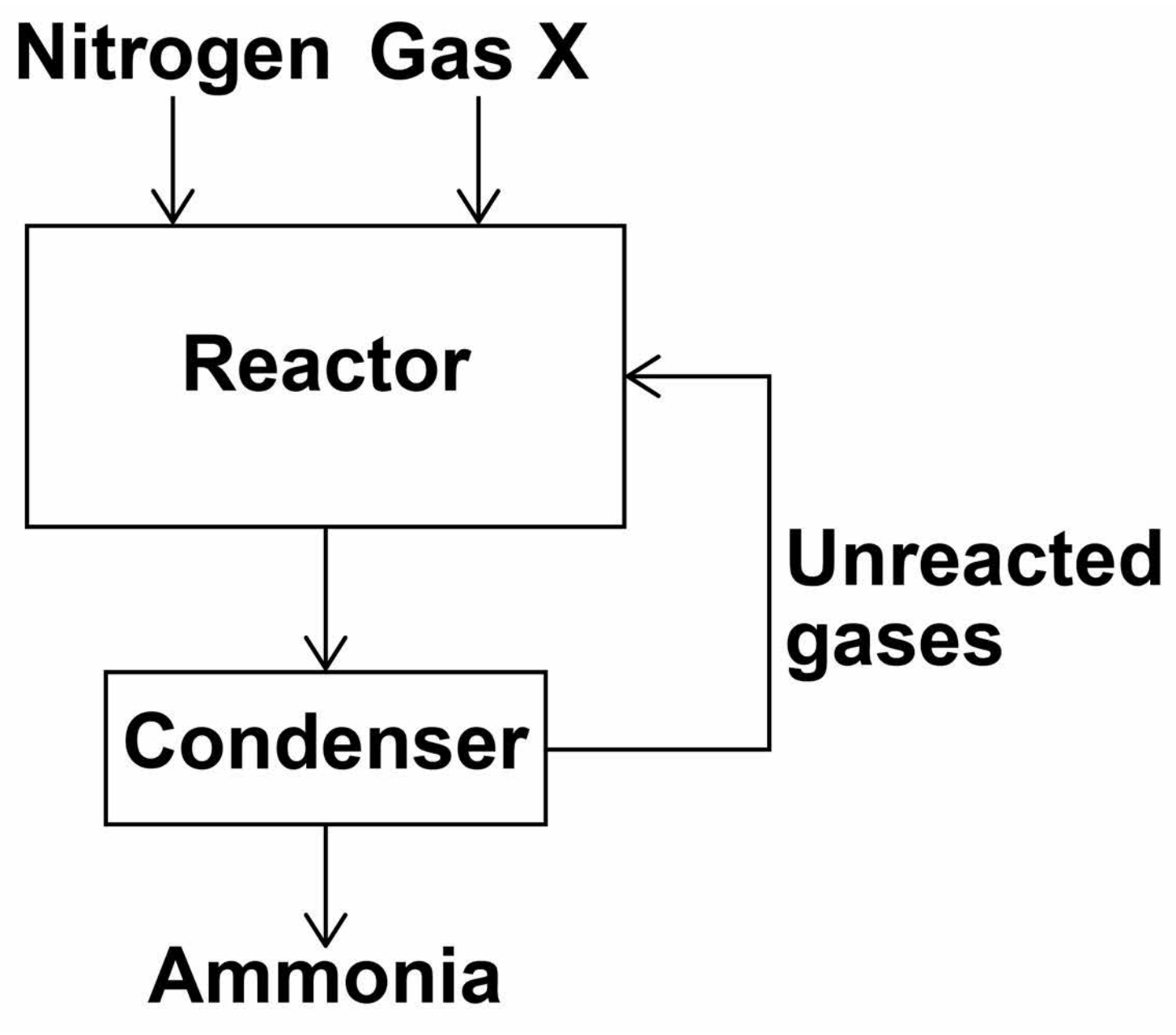
_____

11

1 0 **This question is about gases.**

FIGURE 10 shows how nitrogen is used in the Haber Process to produce ammonia.

FIGURE 10



1 0 . 1 **Gas X in FIGURE 10 is obtained from methane.**

Name gas X. [1 mark]

_____

_____

1 0 . 2 **Give the approximate temperature and pressure used in the reactor. [2 marks]**

Temperature _____

Pressure _____

1 0 . 3 **The mixture of gases from the reactor cools in the condenser.**

Suggest why ammonia condenses but the other gases do not. [1 mark]

_____

_____

_____

The Earth's early atmosphere was different to Earth's atmosphere today.

Scientists think that the Earth's early atmosphere was like the atmosphere found on Venus today.

TABLE 7 shows the amounts of carbon dioxide and oxygen in the atmospheres of Venus and Earth today.

TABLE 7

Gas	Percentage (%) in Venus' atmosphere today	Percentage (%) in Earth's atmosphere today
Carbon dioxide	96.50	0.04
Oxygen	0.00	20.95

1 0 . 4 **The percentages of carbon dioxide and oxygen have changed from Earth's early atmosphere to Earth's atmosphere today.**

Explain the processes that led to these changes. [6 marks]

10.5 Why are scientists NOT certain about the percentage of each gas in the Earth's early atmosphere? [1 mark]

END OF QUESTIONS

11

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There are no questions printed on this page

For Examiner's Use	
Question	Mark
1	
2	
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4	
5	
6	
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10	
TOTAL	