AQA

Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE CHEMISTRY

F

Foundation Tier Paper 2

Wednesday 13 June 2018 Morning Time allowed: 1 hour 45 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
- 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.

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

Do not write outside the box

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?

[1 mark]

Tick **one** box.

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

0 1 . 2 What does the symbol ⇌ mean?

[1 mark]

Tick **one** box.

- Endothermic ☐
- Exothermic ☐
- Reversible ☐
- Polymerisation ☐

Do not write outside the box

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 = _____ %

Question 1 continues on the next page

Do not write outside the box

0 1 . 6 Draw **one** line from each compound to the formula for the compound.

[2 marks]

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

8

Do not write outside the box

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} ?

[1 mark]

Tick **one** box.

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} ?

[1 mark]

Tick **one** box.

Alcohol ☐

Alkane ☐

Carboxylic acid ☐

Ester ☐

Question 2 continues on the next page

Do not write outside the box

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

Do not write outside the box

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

[2 marks]

Tick **two** boxes.

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

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

How could the atmospheric pollution in cities be reduced?

[2 marks]

Tick **two** boxes.

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

9

Do not write outside the box

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**.

Density has been completed for you.

[2 marks]

Tick **three** boxes.

Table 2

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

Do not write outside the box

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:

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

[2 marks]

Mass of uniform made from polymer **K** = _____ kg

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?

[1 mark]

Tick **one** box.

Polymer **L** burns easily ☐

Polymer **L** does not biodegrade ☐

Polymer **L** will not melt ☐

Question 3 continues on the next page

Do not write outside the box

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?

[1 mark]

Tick **one** box.

Polymers are man-made ☐

Polymers are more hard-wearing ☐

Wool is more easily available ☐

Wool is more flame resistant ☐

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

[2 marks]

_____

_____

_____

_____

8

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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

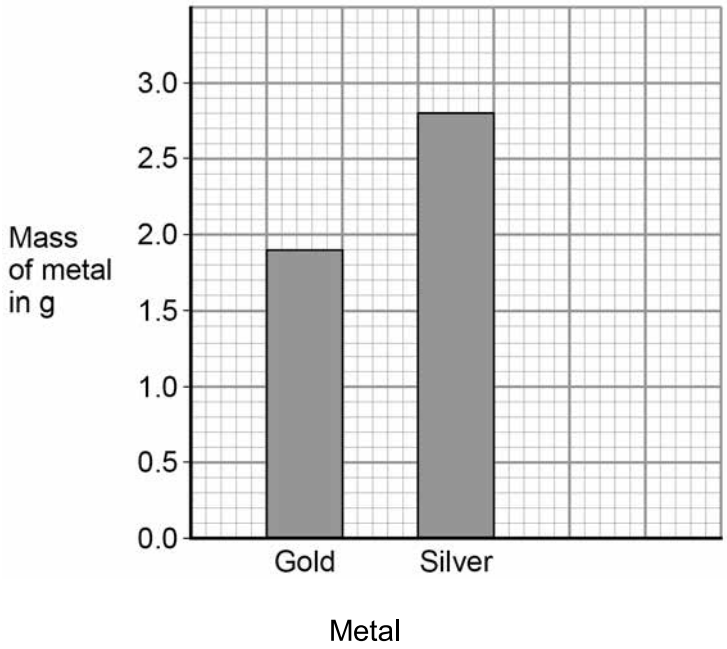
Table 3

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



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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

Question 4 continues on the next page

Do not write outside the box

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

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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?

[2 marks]

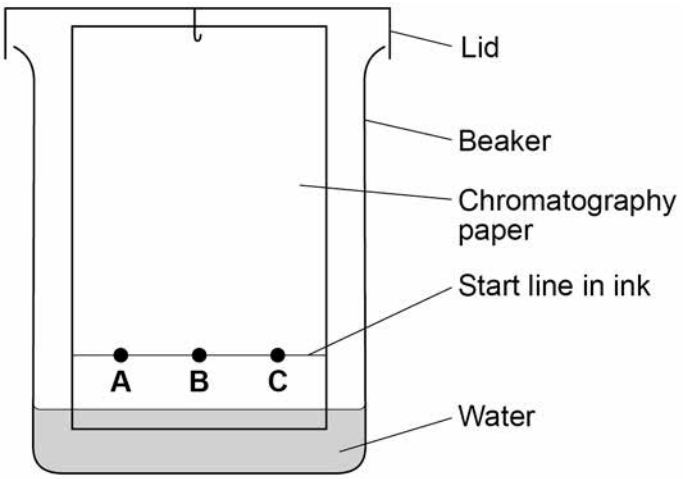
Tick **two** boxes.

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

Do not write outside the box

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

Figure 2



What **two** mistakes did the student make in setting up the apparatus?

[2 marks]

Tick **two** boxes.

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 ☐

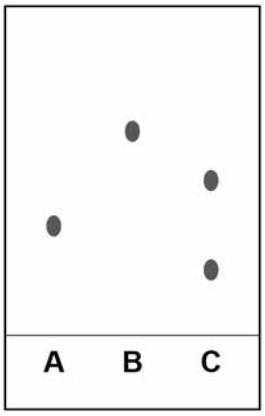
Uses water as the solvent ☐

Question 5 continues on the next page

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**?

[2 marks]

Tick **two** boxes.

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 ☐

Do not write outside the box

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]

R_f value = _____

8

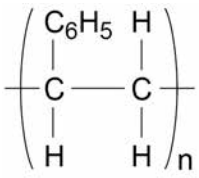
Turn over for the next question

Do not write outside the box

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

Figure 4 represents the structure of poly(styrene).

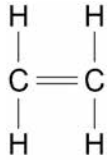
Figure 4



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

[1 mark]

Tick **one** box.



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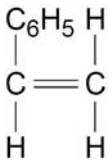

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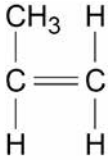

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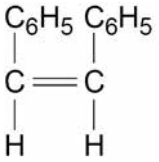

☐

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

[1 mark]

Tick **one** box.

Cracking ☐

Distillation ☐

Fermentation ☐

Polymerisation ☐

0 6 . 3 Complete the sentences.

Choose answers from the box.

[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 _____.

Question 6 continues on the next page

Do not write outside the box

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]

9

Do not write outside the box

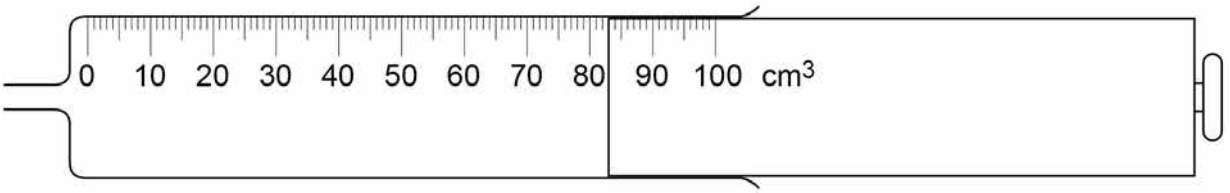
0 7 A student investigated how concentration affects the rate of reaction between magnesium and hydrochloric acid.

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

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

[2 marks]

Tick **two** boxes.

- 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

Do not write outside the box

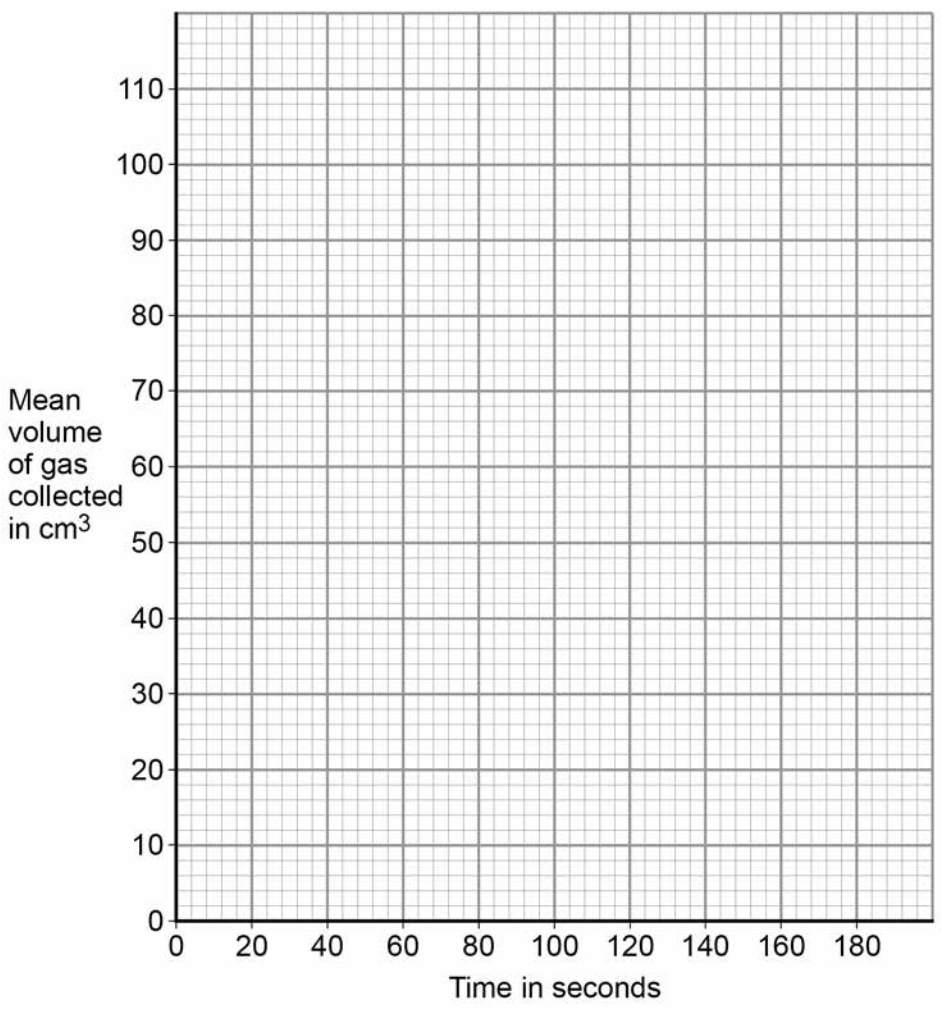
0 7 . 4 Plot the data from **Table 5** on **Figure 6**.

You should include your answer to Question **07.3**.

You do **not** need to draw a line of best fit.

[2 marks]

Figure 6



Question 7 continues on the next page

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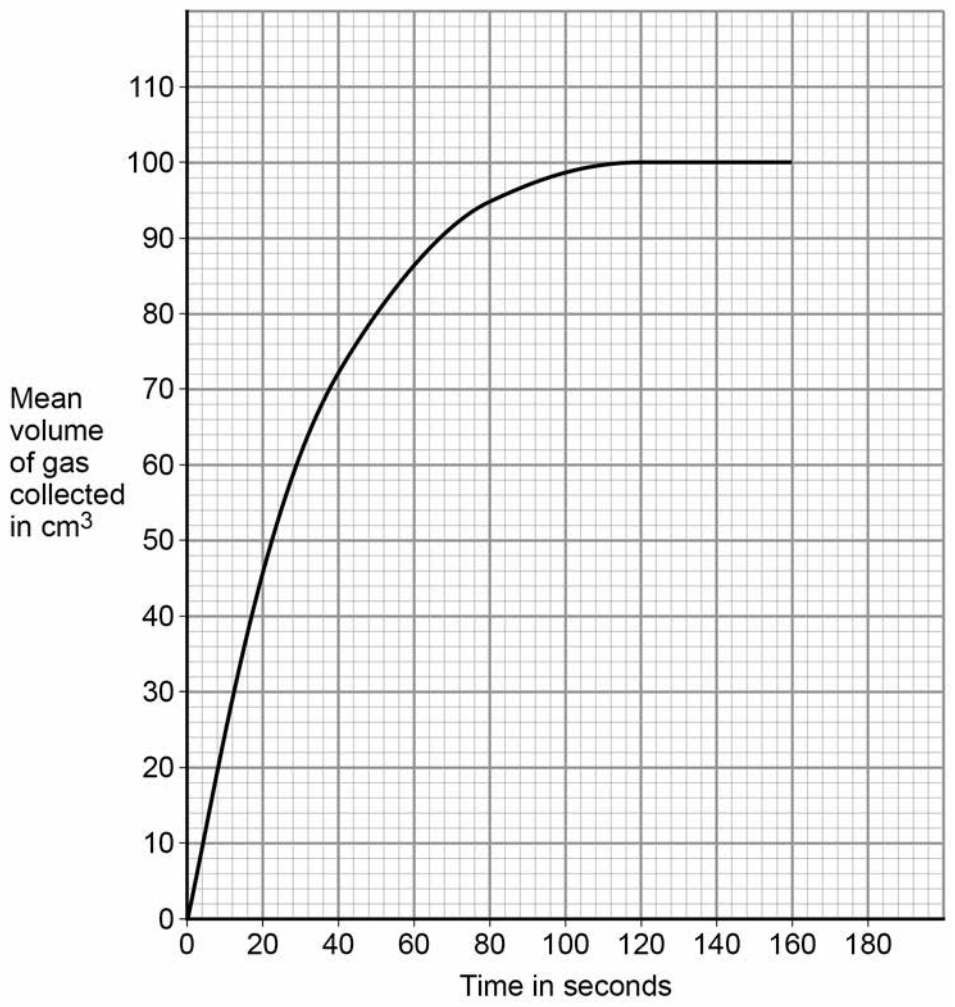
Figure 7 shows results of the experiment with the hydrochloric acid of a higher concentration.

Figure 7



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

Do not write outside the box

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?

[2 marks]

Tick **two** boxes.

- 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 ☐

Question 7 continues on the next page

Do not write outside the box

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]

_____

_____

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 for the next question

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ANSWER IN THE SPACES PROVIDED

Do not write outside the box

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]

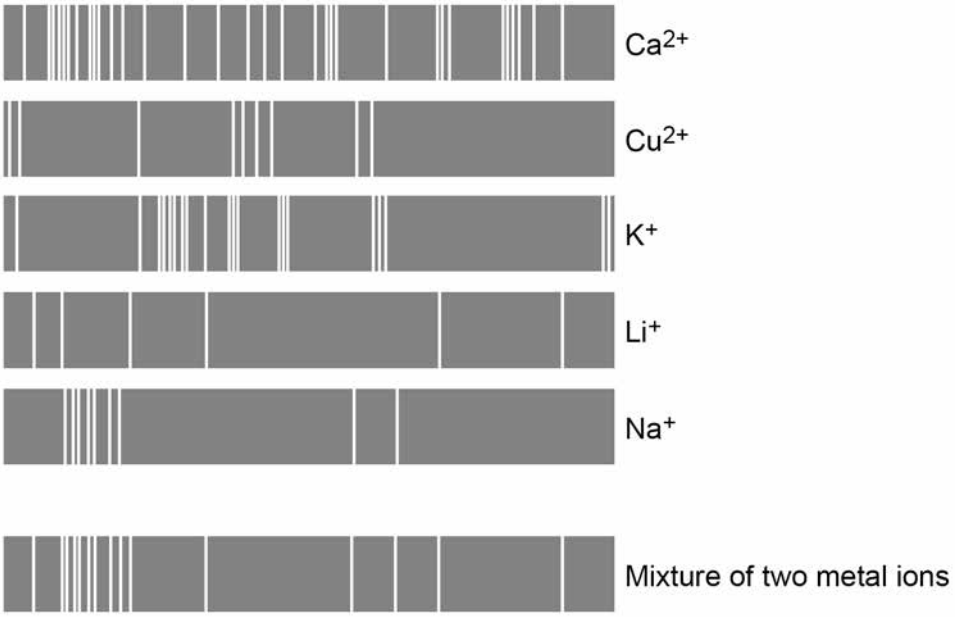
Do not write outside the box

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?

[2 marks]

Tick **two** boxes.

Ca^{2+} ☐

Cu^{2+} ☐

K^+ ☐

Li^+ ☐

Na^+ ☐

Question 8 continues on the next page

Do not write outside the box

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 _____

_____

9

Do not write outside the box

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 = _____ %

Question 9 continues on the next page

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]

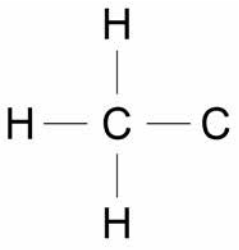
Do not write outside the box

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

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There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

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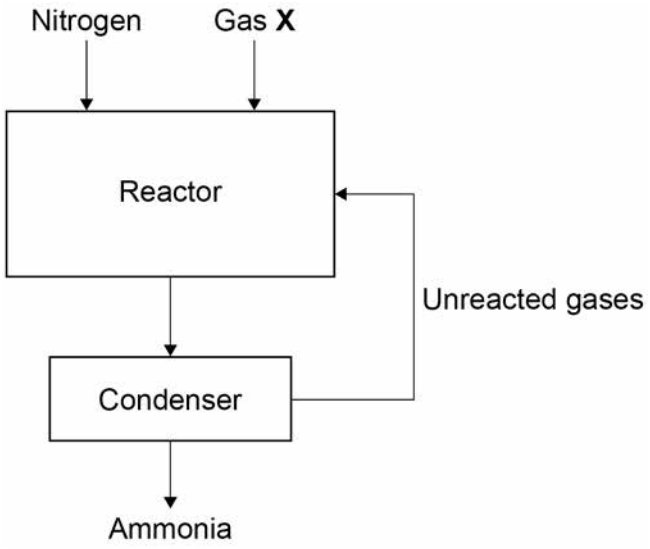
1 0 This question is about gases.

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]

_____

_____

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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]

Do not write outside the box

1 0 . 5 Why are scientists **not** certain about the percentage of each gas in the Earth's early atmosphere?

[1 mark]

11

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED