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**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**

**For this paper you must have:**
- **a ruler**
- **a scientific calculator**
- **the periodic table (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 2 2 F 0 1

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## 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**

**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 =** _____ **%**

**[Turn over]**

**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 |
| | $CuSO_4$ |
| | $H_2O$ |
| Water | $H_2SO_4$ |

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 |

**[Turn over]**

**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**

**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

**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 14.**

**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 | | |

## 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, on page 16, and the equation:**

**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.**

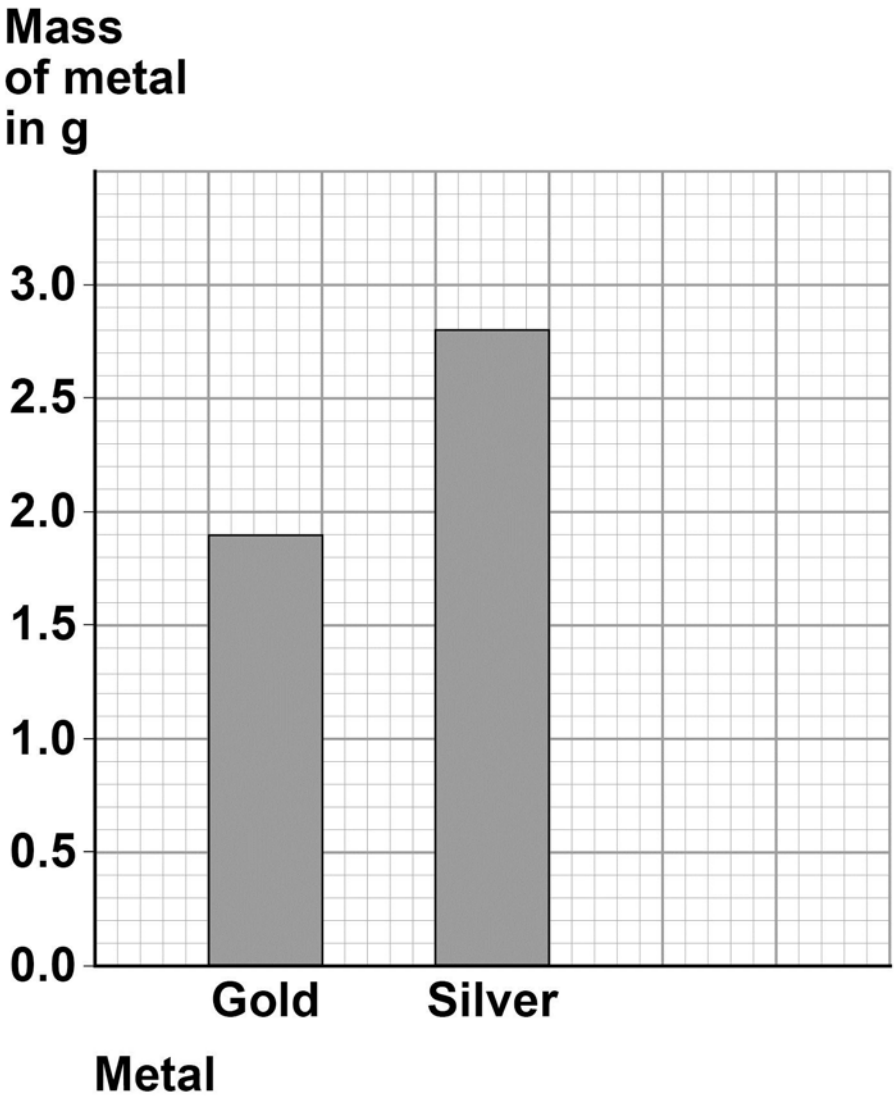
**The mass of the ring is 5.0 g**

**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, on page 24. [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**

**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?**

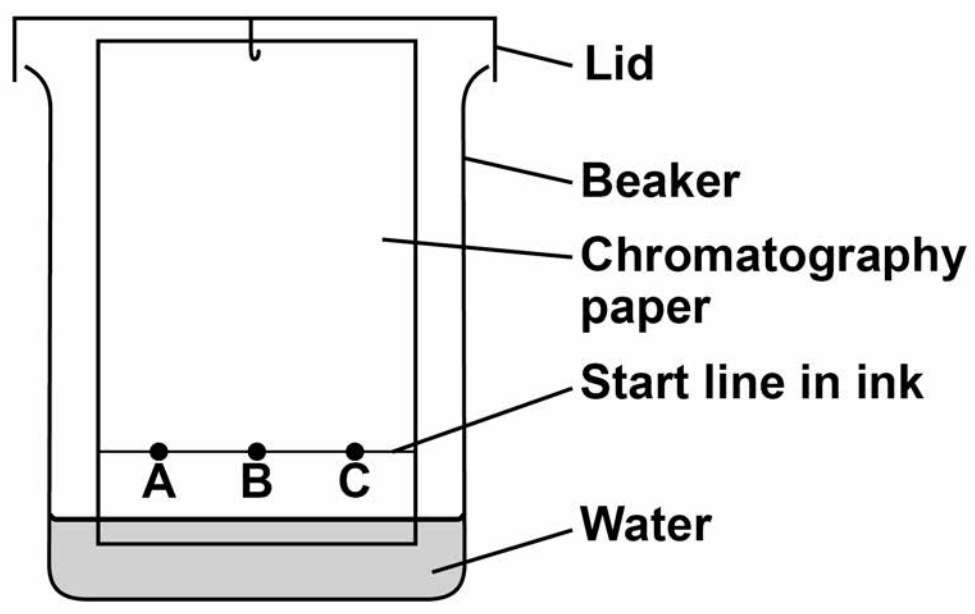
**Tick TWO boxes. [2 marks]**

- ☐ **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]**

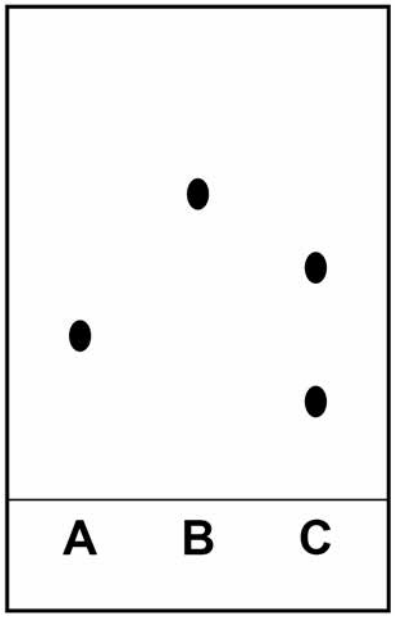
- ☐ **The paper does not touch the beaker**
- ☐ **The start line is drawn in ink**
- ☐ **The water level is below the start line**
- ☐ **Uses a lid on the beaker**
- ☐ **Uses water as the solvent**

**[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]**

_____

_____

_____

**$R_f$ value =** _____

8

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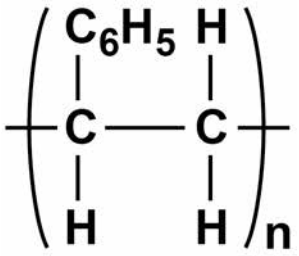
**[Turn over]**

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

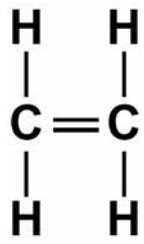
**FIGURE 4 represents the structure of poly(styrene).**

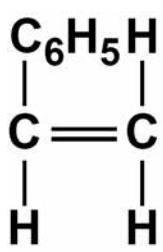
**FIGURE 4**

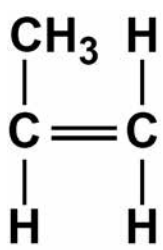


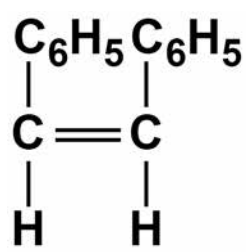
**0 6 . 1** **Which small molecule is used to produce poly(styrene)?**

**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]**

9

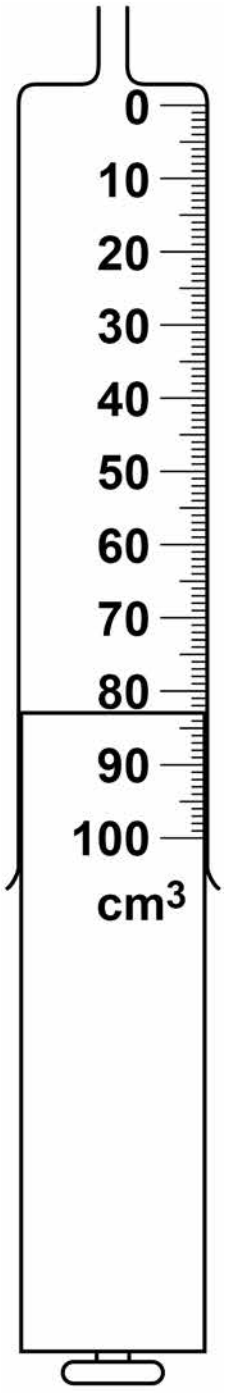
**0 7** **A student investigated how concentration affects the rate of reaction between magnesium and hydrochloric acid.**

**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]**

**BLANK PAGE**

**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, on page 46.**

**Do NOT include the anomalous result in your calculation.**

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

_____

_____

_____

_____

**X =** _____ **$cm^3$**

**[Turn over]**

**Repeat of TABLE 5**

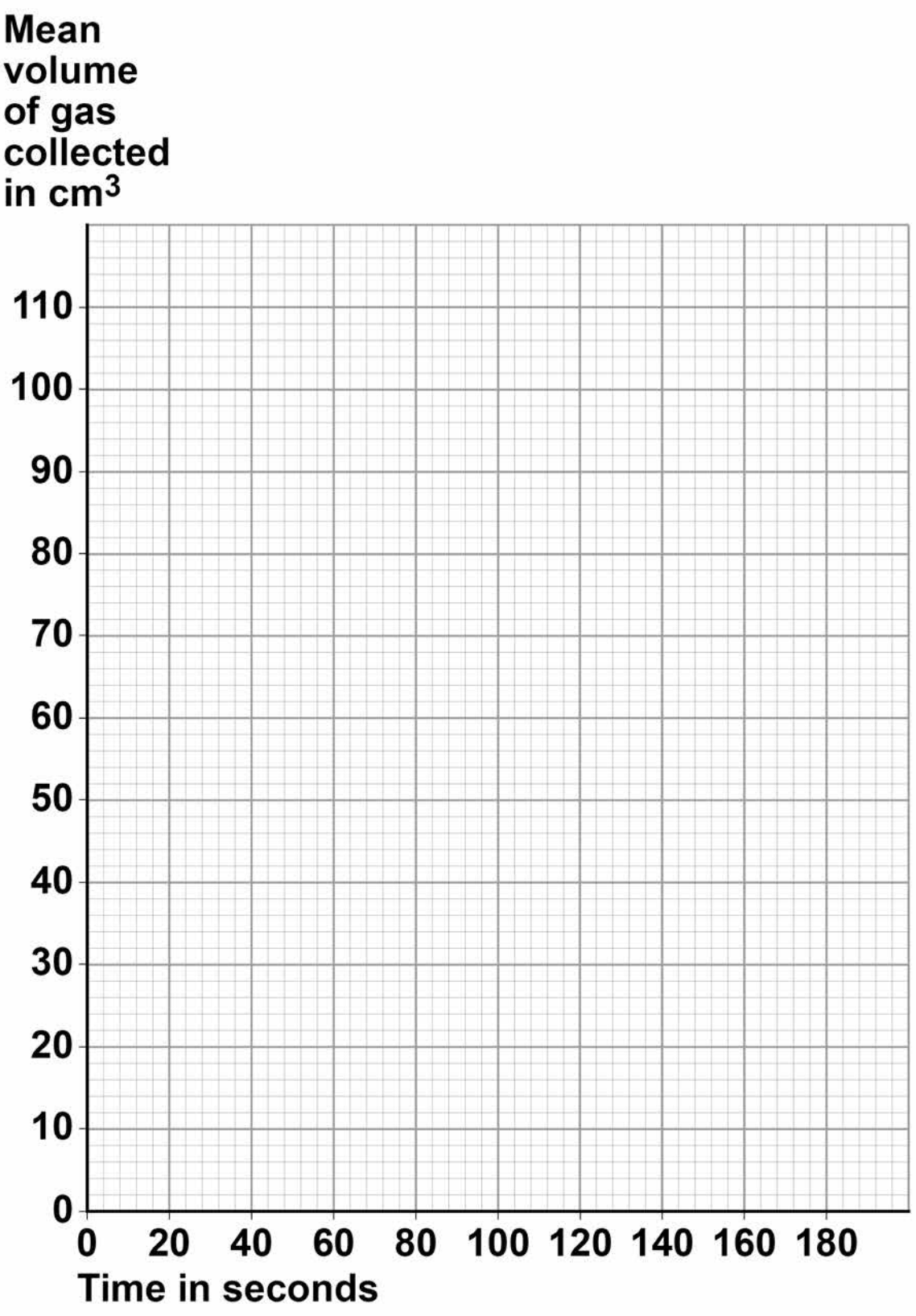
| Time in seconds | Volume of gas collected in $cm^3$ | | | | |
|---|---|---|---|---|---|
| | Test 1 | Test 2 | Test 3 | Test 4 | Mean |
| 0 | 0 | 0 | 0 | 0 | 0 |
| 40 | 46 | 30 | 47 | 49 | X |
| 80 | 78 | 83 | 83 | 82 | 82 |
| 120 | 98 | 94 | 96 | 95 | 96 |
| 160 | 100 | 100 | 100 | 100 | 100 |

**0 7 . 4** **Plot the data from TABLE 5 on FIGURE 6, on page 49.**

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

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

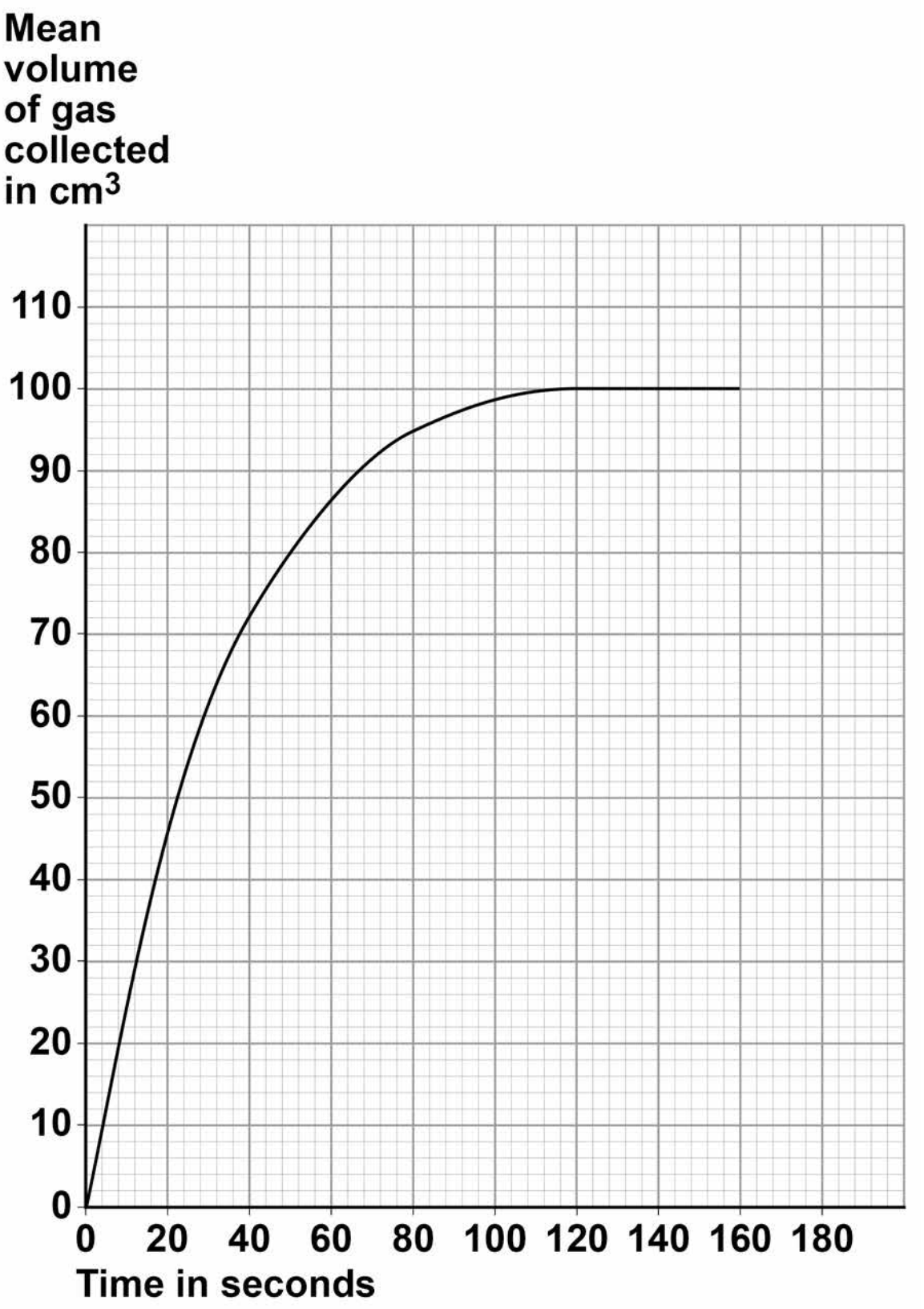
**FIGURE 6**




**[Turn over]**

**FIGURE 7 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:**

**mean rate of reaction =**

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

**[2 marks]**

**Mean rate of reaction = _____ $cm^3/s$**

**[Turn over]**

## Repeat of FIGURE 7

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

**Use FIGURE 7, on page 52. [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]**

**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** _____

**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]**

_____

_____

_____

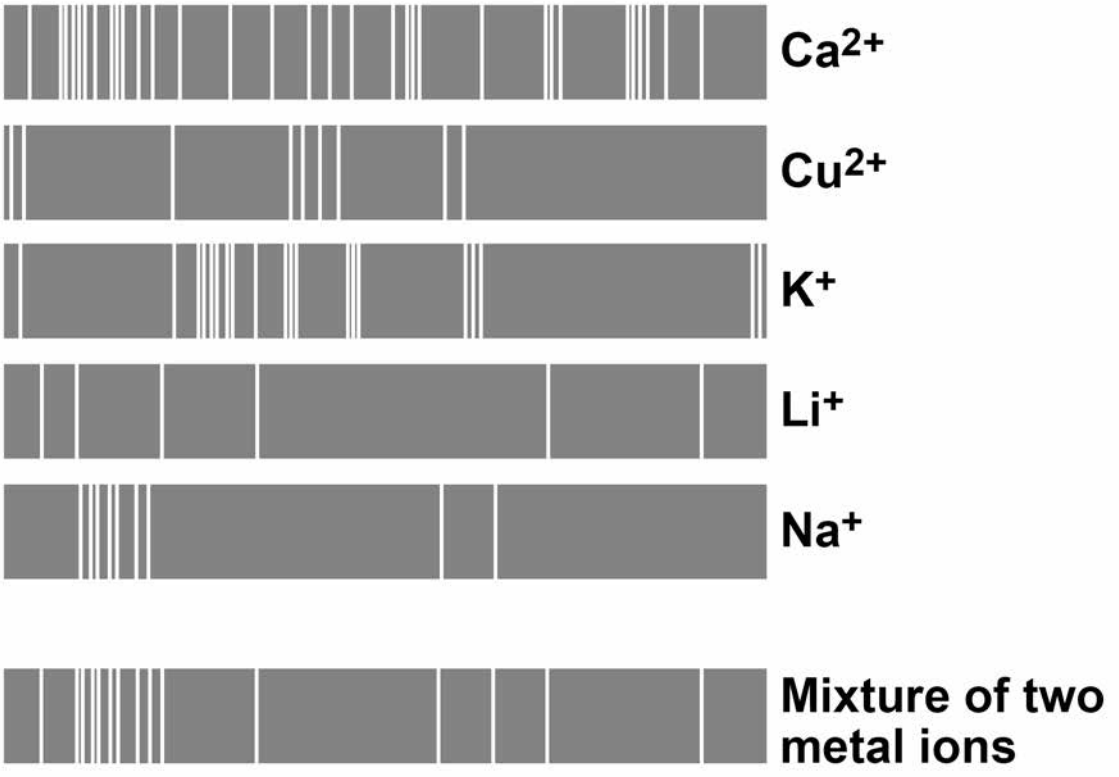
**[Turn over]**

**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, on page 62. [2 marks]**

**Percentage = _____ %**

**[Turn over]**

**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]**

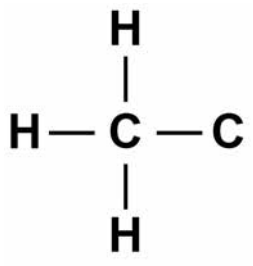
**0 9 . 5** **Describe how ethanol is produced from sugar solution.**

**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]**

_____

_____

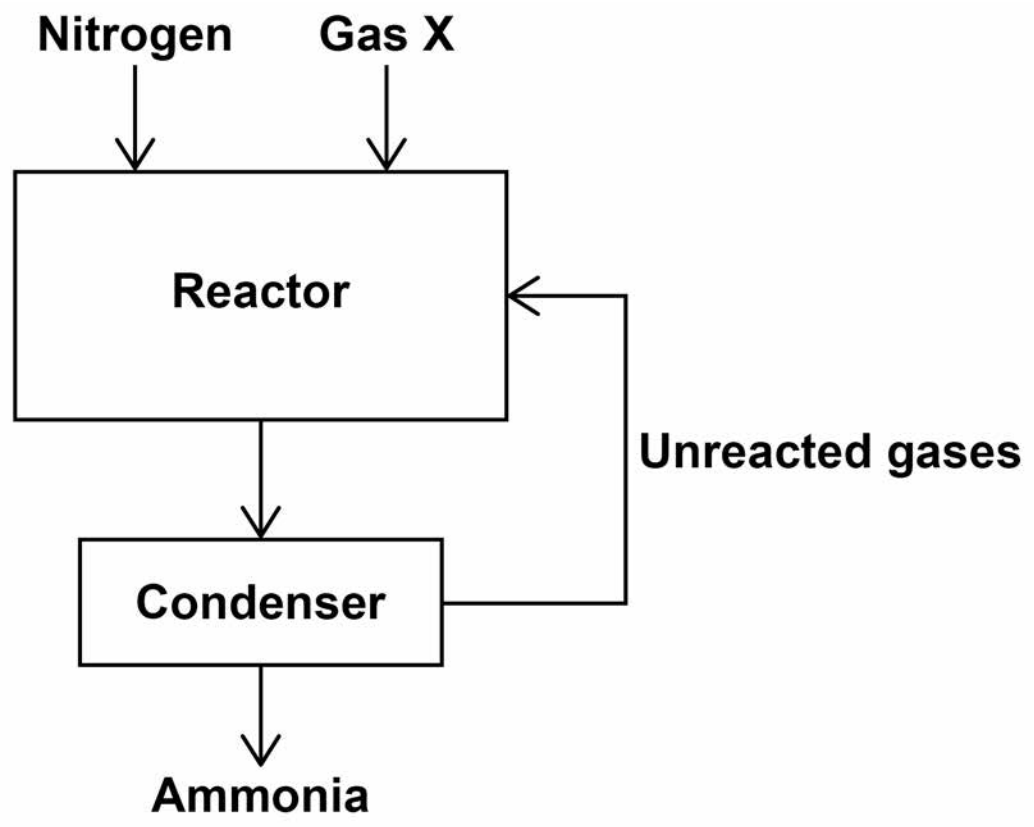
11

**[Turn over]**

**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]**

_____

_____

_____

**[Turn over]**

**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]**

[Turn over]

**1 0 . 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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| For Examiner's Use | |
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| Question | Mark |
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