



Write your name here

Surname

Other names

# Scholarship Paper 2025

**Subject: Chemistry**

**Time: 1 Hour**

**You must have:**

Pen  
Pencil

**Total Marks**  
**60**

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer the questions in the answer sheets provided.
  - *there may be more space than you need.*

## Information

- The total mark for this paper is 60
- The marks for **each** question are shown in brackets
  - *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

1 This question is about the first 30 elements in the Periodic Table.

Name the element which:

(a) is 78% of clean, dry air ..... [1]

(b) has atoms with an electronic structure of 2,8,1 ..... [1]

(c) is extracted from hematite ..... [1]

(d) forms an oxide with a giant covalent structure ..... [1]

(e) is the gas with the slowest rate of diffusion at room temperature  
..... [1]

(f) has an anhydrous chloride which turns pink when water is added  
..... [1]

(g) has aqueous ions which form a white precipitate when added to aqueous silver ions  
..... [1]

(h) forms a blue hydroxide which dissolves in aqueous ammonia  
..... [1]

(i) is added to molten iron to remove impurities in the steel making process  
..... [1]

(j) is used to galvanise iron. .... [1]

[Total: 10]

2 The Group 2 elements Mg to Ba are all silvery-white reactive metals.

(a) (i) Draw a labelled diagram to show the bonding and structure of the Group 2 metals at room temperature.

[2]

(ii) Explain why Mg has a higher electrical conductivity than Na.

.....  
..... [1]

(b) Write an equation for the reaction of magnesium with cold water.

..... [1]

(c) Identify a single reagent that can be used to distinguish separate samples of dilute  $\text{Mg}(\text{NO}_3)_2(\text{aq})$  and dilute  $\text{Ba}(\text{NO}_3)_2(\text{aq})$ .

Explain your answer.

reagent .....

explanation .....

..... [2]

(d) (i) Describe what is observed when  $\text{SrI}_2(\text{aq})$  reacts with concentrated sulfuric acid.

.....  
..... [2]

(ii) Compound **X**, an anhydrous Group 2 bromide, is dissolved in water and titrated against aqueous silver nitrate.

A solution containing 0.250 g of **X** requires 33.65 cm<sup>3</sup> of 0.0500 mol dm<sup>-3</sup>  $\text{AgNO}_3(\text{aq})$  for complete reaction.

Identify **X**.

Show your working.

**X** = ..... [3]

[Total: 11]

3 Copper is a transition element. It has variable oxidation states.

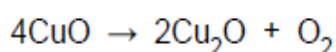
(a) State **two** other chemical properties of transition elements which make them different from Group I elements.

1 .....

2 .....

[2]

(b) When copper(II) oxide is heated at 800 °C it undergoes the reaction shown by the equation.



(i) Identify the changes in oxidation numbers of copper and oxygen in this reaction.

Explain in terms of changes in oxidation numbers why this is a redox reaction.

change in oxidation number of copper: from ..... to .....

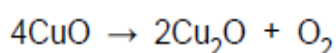
change in oxidation number of oxygen: from ..... to .....

explanation .....

.....

[3]

(ii) Calculate the volume of oxygen, measured at r.t.p., which is formed when 1.60 g of CuO reacts as shown in the equation.



..... dm<sup>3</sup> [3]

(c) Copper metal is obtained when scrap iron is added to aqueous copper(II) sulfate.

(i) The reaction between iron and aqueous copper(II) sulfate is a displacement reaction.

State why this displacement reaction takes place.

.....  
..... [1]

(ii) Write a symbol equation for the reaction between iron and aqueous copper(II) sulfate.

..... [1]

(iii) A displacement reaction is one method for obtaining copper metal from aqueous copper(II) sulfate.

Identify **another** method for obtaining copper metal from aqueous copper(II) sulfate.

..... [1]

[Total: 11]

4 Sulfuric acid has many uses.

(a) Sulfuric acid is a strong acid.

(i) Define the term acid.

..... [1]

(ii) Define the term strong acid.

..... [1]

(b) Dilute sulfuric acid is used to make salts known as sulfates.

A method consisting of three steps is used to make zinc sulfate from zinc carbonate.

**step 1** Add an excess of zinc carbonate to 20 cm<sup>3</sup> of 0.4 mol / dm<sup>3</sup> dilute sulfuric acid until the reaction is complete.

**step 2** Filter the mixture.

**step 3** Heat the filtrate until a saturated solution forms and then allow it to crystallise.

(i) Suggest **two** observations which show that the reaction is complete in **step 1**.

1 .....

2 .....

[2]

(ii) State why it is important to add an excess of zinc carbonate in **step 1**.

.....

..... [1]

(iii) Define the term saturated solution.

.....

.....

..... [2]

(iv) Name **another** zinc compound which can be used to make zinc sulfate from dilute sulfuric acid using this method.

..... [1]

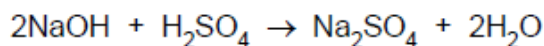
(v) Suggest why this method would **not** work to make barium sulfate from barium carbonate and dilute sulfuric acid.

..... [1]

- (c) In a titration, a student added 25.0 cm<sup>3</sup> of 0.200 mol / dm<sup>3</sup> aqueous sodium hydroxide to a conical flask. The student then added a few drops of methyl orange to the solution in the conical flask.

Dilute sulfuric acid is then added from a burette to the conical flask. The volume of dilute sulfuric acid needed to neutralise the aqueous sodium hydroxide was 20.0 cm<sup>3</sup>.

The reaction is shown by the equation.



- (i) State the colour of methyl orange in aqueous sodium hydroxide.

..... [1]

- (ii) Determine the concentration of the dilute sulfuric acid in g / dm<sup>3</sup> using the following steps.

- Calculate the number of moles of aqueous sodium hydroxide added to the conical flask.

..... mol

- Calculate the number of moles of dilute sulfuric acid added from the burette.

..... mol

- Calculate the concentration of the dilute sulfuric acid in mol / dm<sup>3</sup>.

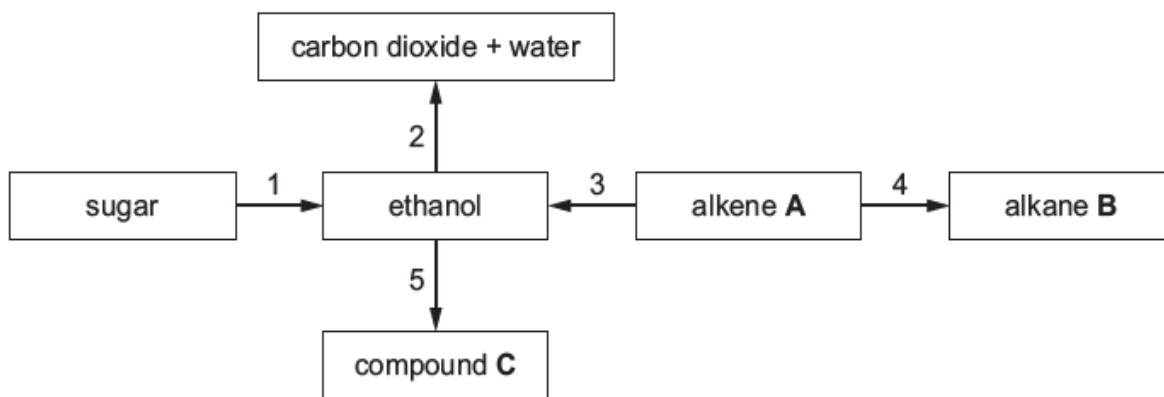
..... mol / dm<sup>3</sup>

- Calculate the concentration of the dilute sulfuric acid in g / dm<sup>3</sup>.

..... g / dm<sup>3</sup>  
[4]

[Total: 14]

5 The reaction scheme shows five organic reactions, numbered 1 to 5.



(a) Name reaction 1.

..... [1]

(b) Name reaction 2 and write the chemical equation for this reaction.

name .....

equation ..... [3]

(c) Reaction 3 forms ethanol from alkene A.

(i) Identify alkene A.

..... [1]

(ii) State the type of reaction that occurs during reaction 3.

..... [1]

(iii) State the reagents and conditions needed for reaction 3.

.....

..... [2]

(d) Alkene A is converted into alkane B in reaction 4.

(i) State the reagent and conditions for reaction 4.

.....

..... [3]

(ii) State the general formula of alkanes.

..... [1]

**(e)** Ethanol is oxidised in reaction 5 by heating it with dilute sulfuric acid and one other reagent.

**(i)** Identify the other reagent in reaction 5.

..... [1]

**(ii)** Name the homologous series compound **C** belongs to.

..... [1]

[Total: 14]

