

MASENO SCHOOL

JULY/AUGUST MOCK - 2024

233/1 – CHEMISTRY Paper 1



NameIndex Number.....

Class DateSignature.....

INSTRUCTIONS

- Write your name and Index Number in the spaces provided above.
- Sign and write the date of examination in the spaces provided above.
- Answer all questions in the spaces provided.
- All working must be clearly shown where necessary.
- Mathematical tables and silent electronic calculators may be used.
- This paper consists of 12 printed pages.
- Candidates should check the question paper to ensure that all pages are printed as indicated and that no questions are missing.
- Candidates should all the questions in English.

For Examiner's Use Only

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 - 28	80	

1. The table below gives the atomic numbers of elements **A**, **B**, **C** and **D**. The letters do not represent the actual symbols of the elements.

Element	A	B	C	D
Atomic number	9	10	11	12

- a) Which one of the elements is unreactive? Explain. (1 mark)

- b) Which two elements would react most vigorously with each other? (1 mark)

- c) Give the formula of the compound formed when the elements in (b) above react. (1 mark)

2. A clean sample of steel wool was placed in a test tube containing some water droplets and the test tube inverted over a trough of water. After three days, the volume of air in the test tube changed from **20 cm³** to **16 cm³** and a brown layer formed on the steel wool.
- (i) Write a chemical equation leading to the formation of the brown layer. (1 mark)

- (ii) A little of the brown solid was dissolved in nitric (V) acid and dilute potassium hydroxide added dropwise until in excess. Write an ionic equation to justify the observation made. (1 mark)

- (iii) State one main disadvantage of the process leading to the formation of the brown layer. (1 mark)

3. Equal volumes of 2M monobasic acids R and S were each reacted with excess magnesium ribbon. The table below shows the volume of the gas produced after one minute.

Acid	Volume of gas (cm ³)
R	80
S	30

- a) Write the ionic equation for the reaction which took place. (1 mark)



- b) Explain the difference in the volumes of the gas produced. (1 mark)

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4. NO₂ and N₂O₄ gases exist in equilibrium at 20°C according to the equation below.



(Pale yellow) **(Brown)**

State and explain the observation that would be made when;

- a) A syringe containing the mixture is heated to 40°C. (1 mark)

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- b) The gaseous mixture is compressed. (1 mark)

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5. (a) Use an equation to explain the acidic nature of an aqueous solution of silicon (IV) chloride (1 mark)

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- (b) Name another metallic chloride which behaves like silicon (IV) chloride. (1 mark)

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- (c) Predict the pH of the resultant mixture formed when a solution of silicon (IV) chloride reacts with solid sodium carbonate. Explain. (1 mark)

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6. When reacting Sulphur (IV) oxide and hydrogen sulphide, some traces of water vapour is required for the reaction to occur.

- a) State the role of water vapour. (1 mark)

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- b) Write an equation for the reaction that occurs. (1 mark)

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- c) Identify the reducing agent in the reaction in (b) above. Explain. (1 mark)

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7. (a) Nitrogen (I) oxide supports combustion of burning charcoal. Write an equation for this reaction. (1 mark)

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- (b) Ammonium nitrate can be heated to give off *nitrogen (I) oxide*. However, a mixture of ammonium chloride and sodium nitrate is preferred. Explain. (1 mark)

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- (c) State the physical test on nitrogen one oxide. (1 mark)

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8. Metals Q and T had their half cells connected to zinc half cell and the following reduction potentials were obtained from each metal.

Metal half cell	Reduction potential
$Q^{2+}(aq)/Q(s)$	-1.37 volts
$T^{+}(aq)/T(s)$	-0.83 volts

- a) What name is given to zinc half cell in this circumstance and predict its reduction potential. (1 mark)

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- b) Metal Q and T were connected to form an electrochemical cell. Write the equation for the half cell reactions that occur at Q (1 mark)

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- c) Calculate the e.m.f of the electrochemical cell above. (2 marks)

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9. Based on kinetic theory of matter, explain why;

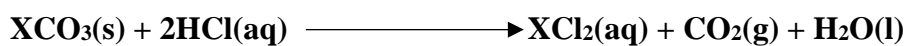
- i. A solid has a definite shape while a gas does not. (1 mark)

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- ii. The temperature of ice rises up to 0°C when heated and then remains constant at 0°C. (1 mark)

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10. A certain carbonate XCO_3 reacts with dilute hydrochloric acid according to the equation below.



If 4g of the carbonate reacts completely with 40cm³ of 2M hydrochloric acid. Calculate the relative atomic mass of X. (3 marks)

(C = 12.0, O = 16.0, Cl = 35.5)

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11. Using dot (.) and cross (x) to represent electrons, show bonding in the compounds below.

(Al = 13, Cl = 17, O = 8)

- a) Aluminium hexachloride (Al_2Cl_6) (1 mark)

- b) Aluminium oxide (Al_2O_3) (1 mark)



12. (a) State *Graham's law of diffusion*. (1 mark)

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(b) 20cm^3 of an unknown gas Q takes 12.6 seconds to pass through a small orifice. 10cm^3 of oxygen gas takes 11.2 seconds to diffuse through the same orifice under the same conditions of temperature and pressure. Calculate the molecular mass of unknown gas Q. (O = 16.0) (3 marks)

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13. Briefly explain how you would obtain pure sample of **lead (II) chloride** from a mixture of lead (II) chloride and silver chloride. (3 marks)

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14. When a hydrocarbon fuel burns, one of the main products is acidic gas **R**.
a) Identify gas R. (1 mark)

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b) What two effects does **gas R** have when its concentration in the atmosphere exceeds its acceptable level. (2 marks)

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15. (a) Define the term relative atomic mass (RAM) (1 mark)

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(b) Element T consists of two isotopes ^{62}T and ^{64}T in the ratio 7:3 respectively.

Calculate the relative atomic mass of element T. (2 marks)

16. Ethanol may be obtained from sugarcane and converted to ethane as shown below.



(i) Give the name of the process that take place in step I. (1 mark)

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(ii) Name the type of reagent and condition in step II. (1 mark)

Reagent

Condition

17. **Sulphur molecule** has a higher melting point than **phosphorus (V) chloride**. Explain the difference in terms of structure and bonding. (2 marks)

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18. Determine the empirical formula of a compound containing the following: Iron 28%, Sulphur 24% and the rest oxygen. (Fe = 56, S = 32, O = 16) (3 marks)

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19. (a) Draw a well labelled diagram on how to prepare and collect wet hydrogen sulphide gas. (2 marks)

- (b) Describe the test for hydrogen sulphide gas. (1 mark)

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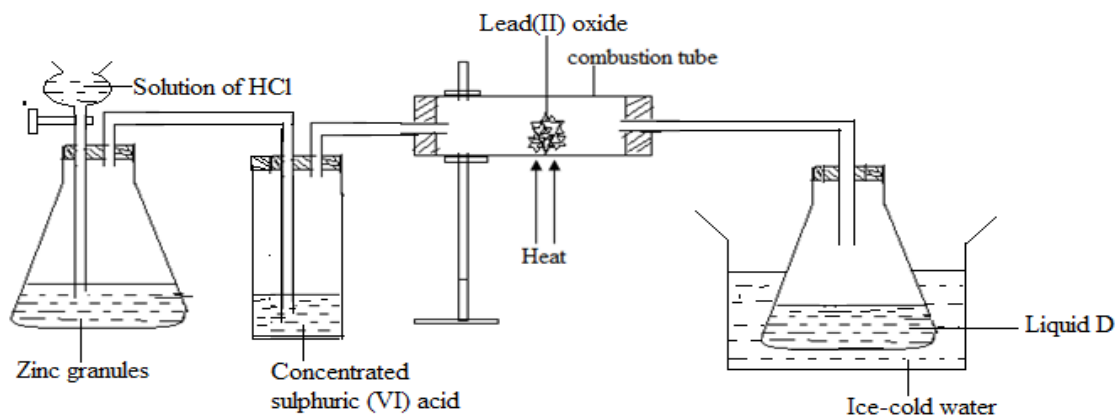
20. (a) Sodium metal reacts with air to form two oxides. Give the formulae of the two oxides. (1 mark)

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- (b) In the Down's cell for extraction of sodium metal, there is a possibility of producing liquid calcium at the cathode where sodium is also formed. Which **TWO** properties of calcium prevent it from mixing with sodium at the cathode. (2 marks)

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21. Below is a diagram showing how hydrogen can be prepared in the laboratory and its reactions with lead (II) oxide.



- a) Name the reducing agents in the two reactions that take place in the set up above. (1 mark)

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- b) State and explain the observation made in the combustion tube. (1 mark)

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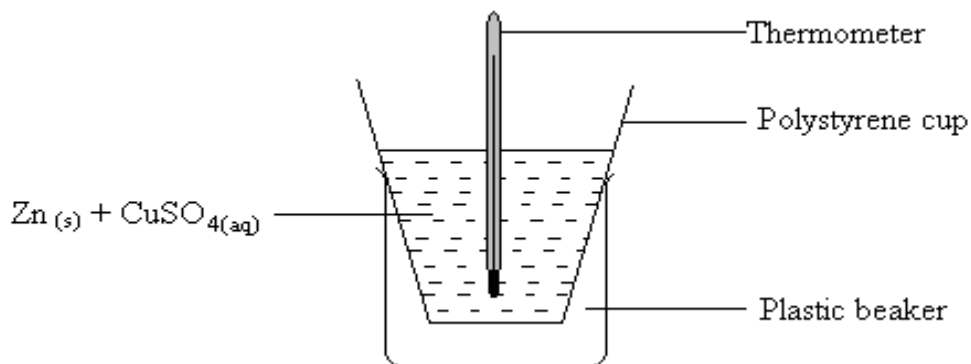
- c) Explain how the purity of liquid D can be determined. (1 mark)

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22. An element P has a RAM of 88. When a current of 0.5 amperes was passed through a fused chloride of P for 32 minutes and 45 seconds. **0.44g** of P were deposited at the cathode. Determine the charge on the ion of P. (**1F= 96500C**) (3 marks)

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23. The apparatus below were used to determine the molar enthalpy of displacement of copper (II) ions.



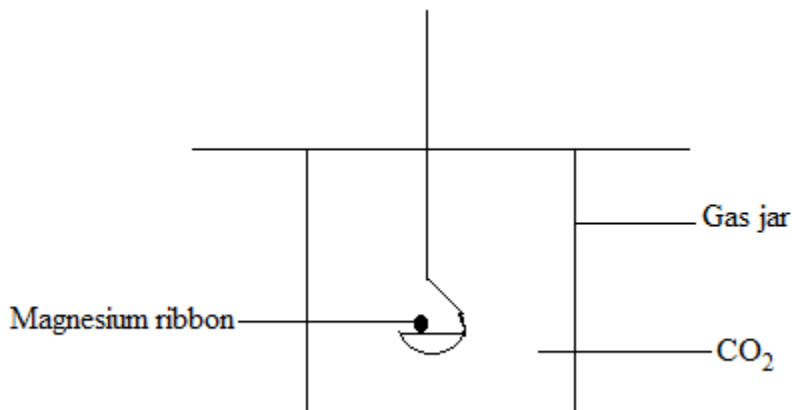
(a) Explain why the polystyrene cup carrying the mixture of copper (II) sulphate and zinc was placed inside the plastic beaker. (1 mark)

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(b) 1.0g of zinc powder was added to **100 cm³ of 0.2M** copper (II) sulphate solution and the mixture stirred gently using a thermometer. The temperature rose from 23°C to 30°C. Determine the molar heat of displacement of copper (II) ions. (Zn = 65.0) (2 marks)

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24. A student lowered a burning magnesium in a gas jar of carbon (IV) oxide as shown in the diagram.



(a) State and explain the observations made in the gas jar. (2 marks)

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(b) Write the equation of the reaction that is taking place in the gas jar. (1 mark)

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25. Study the table below showing tests carried out on a sample of water and the results obtained.

Tests	RESULTS
i) Addition of NaOH solution dropwise until in excess.	White precipitate soluble in excess
ii) Addition of aqueous NH₃(aq) dropwise until in excess.	Colourless solution obtained
iii) Addition of dilute HCl followed by BaCl₂ solution.	White precipitate is formed

(a) Identify the **anion** present in water. (1 mark)

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(b) Write an ionic equation for the reaction in (iii) above. (1 mark)

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(c) Write the formula of the complex ion formed in (ii) above. (1 mark)

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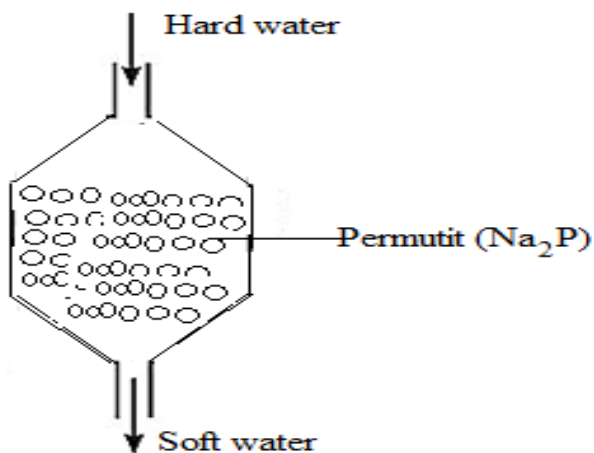
26. (a) Explain why the ability of temporary hard water to conduct electricity falls when water is boiled but it does not fall when temporary hardness is removed by addition of washing soda. (1 mark)

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(b) The column below was used to soften hard water.



- (i) After sometime the material in the column is not able to soften hard water. How can the material be reactivated. (1 mark)

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- (ii) Explain how the hard water was softened as it passes through the column. (1 mark)

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27. (a) Define the term radioactivity. (1 mark)

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- (b) Give two differences between nuclear and chemical reactions. (2 marks)

Nuclear reactions	Chemical reactions

28. Give the name of the apparatus that can be used to prepare **2M NaOH** solution in the laboratory. (1 mark)

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