

CENTRAL EAST EDUCATION DIVISION EXAMINATIONS BOARD**2024 MALAWI SCHOOL CERTIFICATE OF EDUCATION****CHEMISTRY**

Subject number: M038/I

Time Allowed: 2 hours

PAPER I
(100 Marks)**Theory****Instructions**

- This paper contains 11 printed pages please check**
- Fill in your **name** at the top of each page.
- This paper contains two sections, **A** and **B**. In section **A** there are **13** short answer questions while in section **B** there are **5** restricted essay questions.
- Use of electronic calculators is allowed.
- The maximum number of marks is indicated for each question.
- In the table provided on this page **tick** against the number of the question you have answered.
- Hand in your question paper to the invigilator when time is called to stop writing.

Question number	Tick if answered	Do not write in these columns	
1.			
2.			
3.			
4.			
5.			
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7.			
8.			
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10.			
11.			
12.			
13.			

Turn over

Section A

1. a. Define the term ‘hydrated salt’.

(1 mark)

- b. Calculate the percentage composition of water of crystallisation in hydrated copper sulphate whose molecule is $\text{CuSO}_4 \cdot 4\text{H}_2\text{O}$. (A_r Cu = 64, S = 32, O = 16, H = 1)

- c. 5.2g of calcium oxide, CaO was obtained using the chemical equation below:



(A_r for Ca = 40, O = 16 and C = 12).

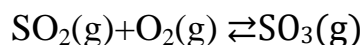
Calculate percentage yield of calcium oxide from the reaction in 1c.

(3 marks)

2. a. Define the term “rate of reaction”.

(1 mark)

- b. Given the reaction between Sulphur dioxide (SO_2) and Oxygen (O_2) below:

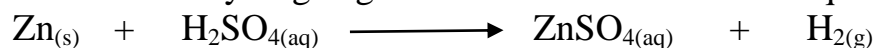


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What will be the effect on the position of the equilibrium if temperature of the reactants is increased when the system is in the chemical equilibrium state? Explain your answer.

(3 marks)

- c. Zinc powder reacts with a dilute sulphuric acid producing zinc sulphate solution and hydrogen gas as shown in the chemical equation below:

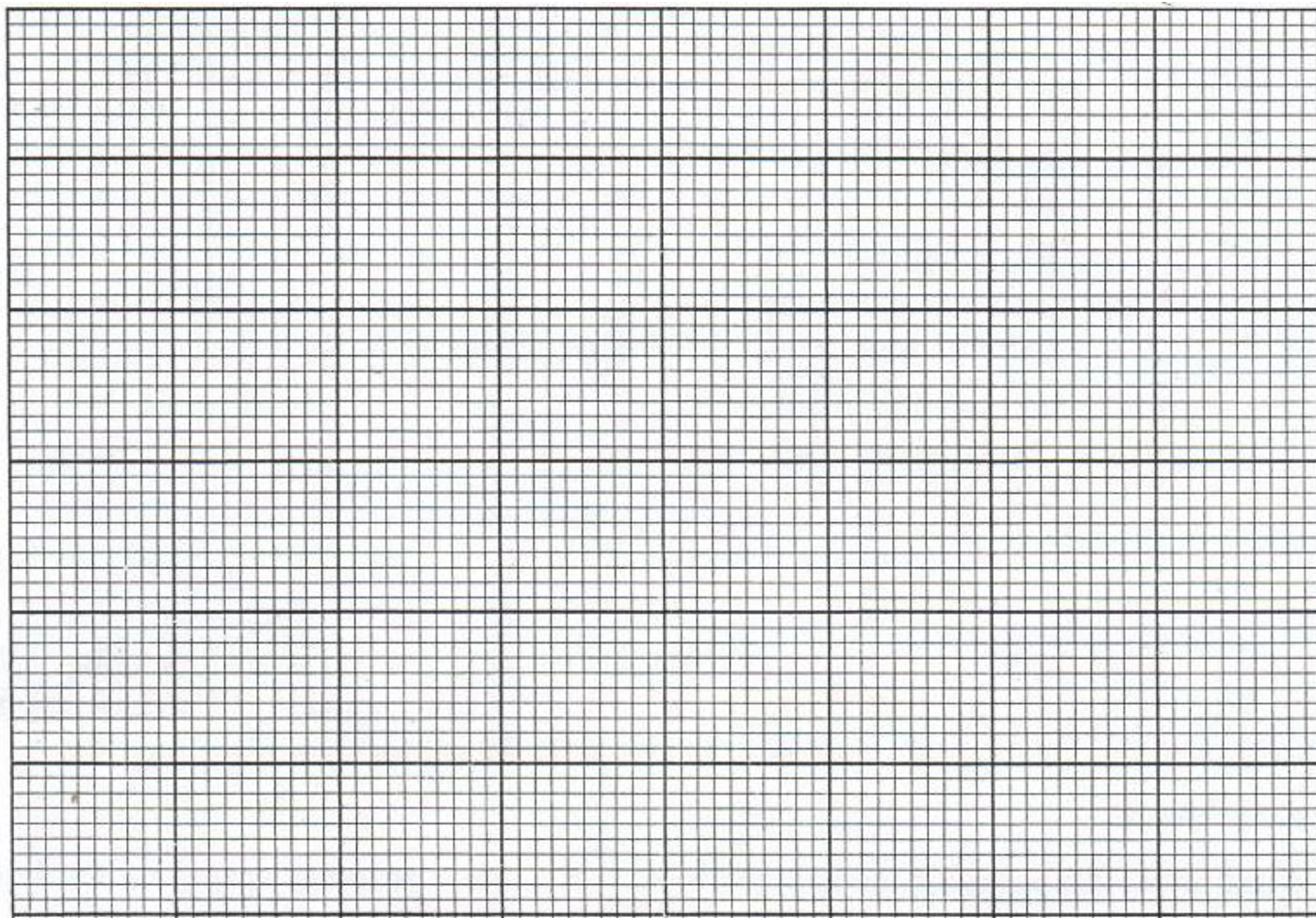


Plot a graph of volume of hydrogen gas produced against time taken using the results in the **Table 1** provided below:

Table 1

Volume of hydrogen gas (cm ³)	0	5	10	50	100	120	120
Time Taken (s)	0	30	60	90	120	150	180

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(5 marks)

3. a. Describe **two** methods that can be used to remove permanent hardness in water.

(4 marks)

b. What are greenhouse gases?

(1 mark)

c. Explain how carbon dioxide and methane contribute to global warming.

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(2 marks)

4. Given below are general formulae of homologous series of organic compounds.

M: $C_nH_{2n+1}COOH$

N: C_nH_{2n+2}

P: $C_nH_{2n+1}CHO$

Q: $C_nH_{2n+1}COC_nH_{2n+1}$

R: C_nH_{2n}

a. Which homologous series represent hydrocarbons?

(2 marks)

b. Draw a structure of a member of **M** whose n is 3, hence name the compound



(2 marks)

c. Draw a structure of 4,4 dimethyl pent-2-ene



(3 marks)

5. a. What are allotropes?

(1 mark)

b. **Figure 2** shows allotropes of carbon.

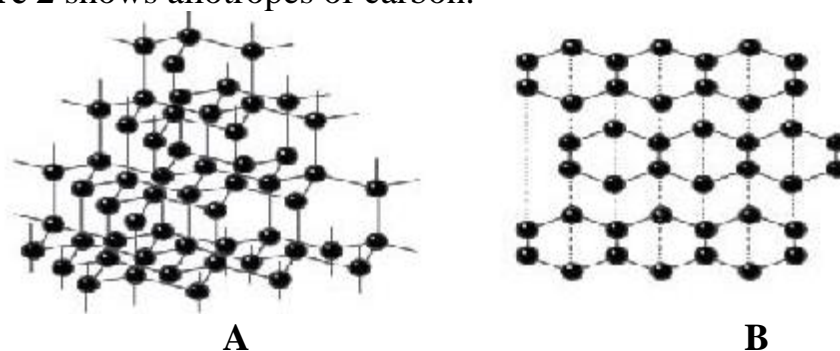


Figure 2

Identify these allotropes.

A _____ (1 mark)

B _____ (1 mark)

c. Give any **three** differences between oxygen and ozone gases.

(3 marks)

6. a. **Figure 1** is a graph of atomic radius across the period against atomic number for some elements in the periodic table.

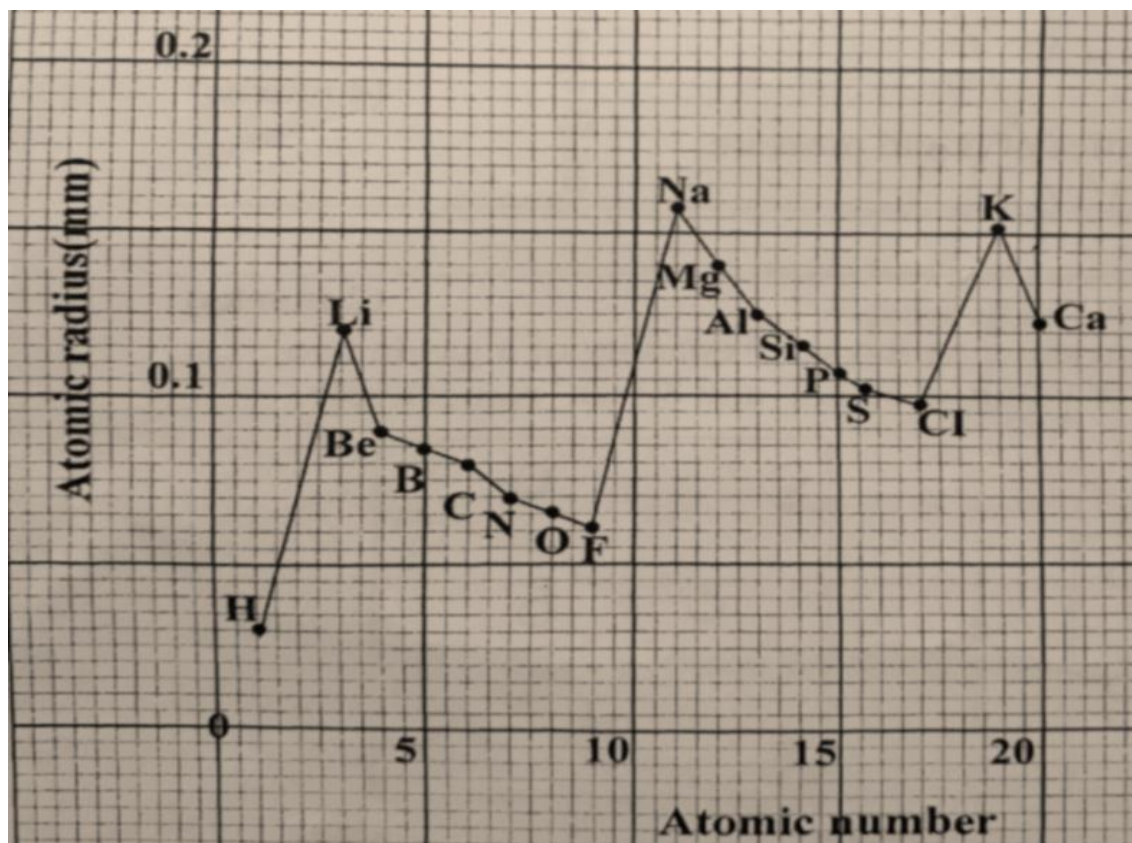


Figure 1

- (i) Which Group **II** element has the largest atomic radius?

(1 mark)

- (ii) Why is there a sudden increase in atomic radius from Cl to K?

(2 marks)

- b. Draw electron dot and cross diagrams for the reaction between Sodium (Na) and Chlorine (Cl) to form Sodium Chloride (NaCl).

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(2 marks)

7. a. (i) Explain the difference between bond breaking and bond formation.

(2 marks)

b. **Table 2** below shows bond energy values. Use it to answer the questions that follow.

Table 2

Bond	Energy (KJ)
$\text{N} \equiv \text{N}$	410
$\text{N} - \text{H}$	391
$\text{H} - \text{H}$	435

(i) Determine the enthalpy change when hydrogen (H_2) gas react with Nitrogen (N_2).

(5 marks)

(ii) What conclusion can you make from the reaction?

(1 mark)

8. a. What is a chemical bond?

(1 mark)

b. Discuss any **two** properties of ionic compounds.

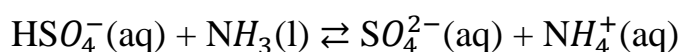
Name: _____ School: _____

(4 marks)

c. Explain how covalent bonding is formed.

(2 marks)

9. a The following is a reaction between HSO_4^- and NH_3 :



(i) Explain the meaning of the \rightleftharpoons

(1 mark)

(ii) Identify the conjugate acid – base pairs in the above reaction

(2 marks)

b. Form 4 students at Zenga Secondary School reacted propane (C_3H_8) and Chlorine (Cl_2).

(i) Mention a chemical waste from the reaction

(1 mark)

(ii) Explain how the waste above would be disposed

(2 marks)

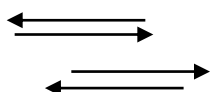
10. a (i). Calculate the oxidation number of R in RMnO_4 if oxidation number of Mn = +7 and O = -2

(3 marks)

d. **Table 3**, shows electrochemical series with voltage series

Table 3

Electrochemical series	E^0 ; Voltage series
------------------------	------------------------



Name: _____ School: _____

$Mg^{2+}(aq) + 2e^{-}$ Mg(s)		-2.36
$Pb^{2+}(aq) + 2e^{-}$ Pb(s)	Pb	-0.13

If the cell is represented as follows

$Mg(s)/Mg^{2+}(aq) // Pb^{2+}(aq)/Pb(s)$

Calculate the standard potential electrodes

(3 marks)

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(10 marks)

13. With the aid of a well-labelled diagram, describe an experiment that can be done to show that ionic compounds conduct electricity only in aqueous state and not in solid state.

(10 marks)

END OF QUESTION PAPER

NB: This paper contains 11 pages