CANDIDATE NAME: _____

NENO DISTRICT MOCH EXAMINATION

2022 MALAWI SCHOOL CERTIFICATE OF EDUCATION

CHEMISTRY

Subject Number: M038/I

Time allowed: 2 hours

Tuesday, 31 May **2:00 – 4:00 pm**

PAPER I

(100 marks)

Theory

Instructions

1. This paper contains **12 printed pages.** Please check.
2. Fill in your examination number on top of every page.
3. This paper contains two sections, A and B. In sect there are 10 short answer questions while in sectio there are three restricted essay questions.
4. Answer all the thirteen questions in the spaces provided.
5. Use of electronic calculators is allowed.
6. The maximum of marks for each answer is indicat against each question.
7. In the table provided on this page, tick against the number of the question you have answered.

Question number	Tick if answered		
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

SECTION A (70 marks)

1. a. Hydrogen gas (H_2) and Chlorine (Cl_2) gas react to form Hydrogen chloride (HCl).

$$H_2 + Cl_2 \longrightarrow 2HCl$$

If the total energy required to break the reactants bonds is $678kJ$ and total energy produced is $862kJ$.

i. State whether the reaction is endothermic or exothermic?

_____

(1 mark)

ii. Give a reason for the answer in **1. a. i**.

_____

_____

(1 mark)

b. Two elements **X** and **Y** form ions with the electron configuration as shown below.

X^- : 2, 8, 8 and Y^+ : 2, 8, 8

Write down the electron configuration of the atoms of **X** and **Y**.

X: _____

(1 mark)

Y: _____

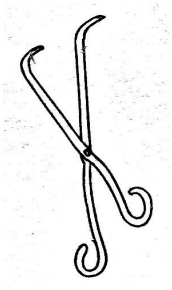
(1 mark)

c. Hydrocarbon containing 92.3% Carbon and 7.7% Hydrogen by mass. Determine its empirical formula. ($Hint$: $RAM\ C = 12,\ H: 1$)

(4 marks)

Continued/…

2. a. **Figure 1** below shows a laboratory apparatus.



i. Name the apparatus shown in the **Figure** above.

_____

(1 mark)

ii. State the use of apparatus.

_____

(1 mark)

3. a. **Table 1** shows results of an experiment on displacement reactions involving zinc (*Zn*), aluminium (*Al*), tin (*Sn*) and iron (*Fe*) metals and their aqueous solutions.

Table 1

	$ZnSO_4$ (aq)	**$AlSO_4$ (aq)**	**$SnSO_4$ (aq)**	**$FeSO_4$ (aq)**
Zinc (Zn)		No reaction	Reaction	Reaction
Aluminium (Al)	Reaction		Reaction	Reaction
Tin (Sn)	No reaction	No reaction		No reaction
Iron (Fe)	No reaction	No reaction	Reaction	

i. Write a balanced chemical equation for the reaction between zinc (Zn) and sulphate ($FeSO_4$) solution.

_____

(2 marks)

ii. Use the results to arrange the metals in order of increasing reactivity.

_____

(2 marks)

iii. Which of the metals above is the strongest reducing agent?

_____

(2 marks)

Continued/...

3. (**Continued**)

b. Below are electrode potentials of some half-reactions.

Half – reaction	**Electrode Potential (F^0 volts)**
$Zn\,(s) \longrightarrow Zn^{2}\,(aq)$	$-\ 0.76$
$Cu^{2+}\,(aq) + 2e^{-} \longrightarrow Cu(s)$	$+\ 0.43$

i. Write a line notation for the reactions above

(2 marks)

ii. Calculate the **e.m.f** of the cell.

(3 marks)

4. i. What is the difference between precision and accuracy of an experimental result?

_____

_____

(2 marks)

ii. State any one way of disposing syringes and needle wastes.

_____

_____

(1 mark)

Continued/…

5. a. Mention two allotropes of Sulphur.

_____

_____

(2 marks)

b. Explain the difference between polar and non-polar covalent bonding.

_____

_____

_____

(2 marks)

c. Draw electron dot and cross diagrams for the bonding between sodium (Na) and chlorine (Cl) to form sodium chloride.

(2 marks)

6. Calcium carbonate can be decomposed by heating according to the following equation:

$$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$$

i. What is the percentage yield in this reaction if $13.2g$ of the calcium oxide (CaO) is obtained on heating $25.9g$ of Calcium carbonate ($CaCO_3$)?
$RAMs$: $Ca = 40,\ 0 = 16,\ C = 12$

(3 marks)

Continued/…

7. a. With relevant examples, differentiate saturated hydrocarbons from unsaturated hydrocarbons.

_____

_____

_____

(2 marks)

b. i. Draw a molecular structure of a tertiary alcohol with 5 carbons.

(2 marks)

ii. Explain why only small alkanols dissolve in water.

_____

_____

(2 marks)

c. Mention the acid which could be used to prepare ammonium chloride (NH_4C).

_____

(1 mark)

d. Name a gas produced in each of the following preparations of salts:

i. Reacting an acid with a metal

_____

(1 mark)

ii. Reacting an acid with a carbonate

_____

(1 mark)

Continued/…

8. a. A certain sample was analyzed in the laboratory and the results were recorded in the figure below:

i. Calculate the relative flow values of components **B** and **D**

(3 marks)

ii. Which components has the highest R_1 value.

_____

(1 mark)

iii. State whether **A** is a pure substance or not and explain.

_____

_____

_____

(2 marks)

b. Why do you think R_1 values are important in Chemistry. Give two points.

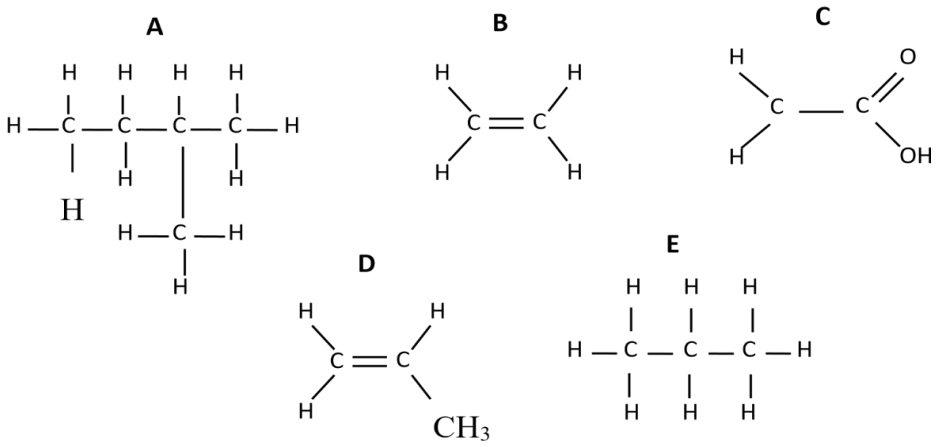
_____

_____

(2 marks)

Continued/…

9. **Figure 2** shows structure of some organic compounds **A**, **B**, **C**, **D**, and **E.**



i. Name compound **A.**

_____

(1 mark)

ii. Which compound is soluble in water?

_____

(1 mark)

iii. Give a reason for the answer in 9. ii.

_____

(1 mark)

iv. Compound **B** is a monomer. Write an equation to show its polymerization.

_____

(2 marks)

v. Mention the type of polymerization in **iv** above.

_____

(1 mark)

vi. Write the names of the other isomers for the substance **A** above.

_____ **(1 mark)**

_____ **(1 mark)**

10. a. Study the equation below and answer the questions that follow.

$$Al(s) + Ag^{+}(aq) \longrightarrow Al^{3+}(aq) + Ag(s)$$

i. Which substance has been reduced?

_____

(1 mark)

Continued/…

10. (**Continued**)

ii. Which substance has been oxidized?

_____

(1 mark)

iii. Write oxidation and reduction half equations

Oxidation half equation

_____

(1 mark)

Reduction half equation

_____

(1 mark)

b. i. Define the mole.

_____

_____

(1 mark)

ii. Calculate the number of moles that are contain in 20g of sodium hydroxide.

(Na) $(L = 6.023 \times 10^{23})$

(2 marks)

iii. Calculate the percentage composition of Nitrogen in $Ca(NO_3)_2$.

(2 marks)

Continued/…

SECTION B (30 marks)

11. a. Describe the test that can distinguish ketones from aldehydes

(6 marks)

b. Describe the meaning of 3Rs as used in waste management.

(6 marks)

Continued/…

12. Describe how $250\ cm^3$ of $0.5M$ of Sodium hydroxide solution (*NaOH*) could be prepared using Sodium hydroxide crystals.
$RAMs\ Na = 23\ 0 = 16\ H = 1$

(10 marks)

Continued/…

13. With the aid of a diagram. Design an experiment which can be conducted to distinguish a strong acid from a weak acid using conductivity circuit.

(10 marks)

END OF QUESTION PAPER

NB: This contains 12 pages. Please check.