EXAMINATION NO.: _____

THE MALAWI NATIONAL EXAMINATIONS BOARD

2023 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

CHEMISTRY

Subject Number: M038/I

Wednesday, 12 July

Time Allowed: 2 hours
8:00 – 10:00 am

PAPER I

(100 marks)

Theory

Instructions

1. **This paper contains 12 printed pages. Please check.**
2. Write your **Examination Number** at the top of each page of this question paper.
3. This paper contains two sections, **A** and **B**. In Section **A** there are **ten** short answer questions while in section **B** there are **three** restricted essay questions.
5. Use of scientific calculator is allowed.
6. The maximum number of marks for each answer is indicated against each question.
7. In the table provided on this page, tick against the number of the question you have answered.
8. 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			
6			
7			
8			
9			
10			
11			
12			
13			

Section A (70 marks)

Answer **all** the questions in this section in the space provided.

1. a. **Table 1** shows the formulae and boiling points of two compounds: **A** and **B**.

Table 1

Compound	Formula	Boiling point (°c)
A	$MgCl_2$	1418
B	CH_4	-161

(i) In which form does compound **A** and **B** exist at room temperature?

A: _____ **(1 mark)**

B: _____ **(1 mark)**

(ii) Give a reason for your answer in **1 a. (i)**.

_____

_____

(1 mark)

b. Give any **three** reasons why the boiling point of compound **A** is very high than the boiling point of compound **B**.

_____

_____

_____

(3 marks)

c. (i) Which compound would dissolve in a polar solvent?

_____

(1 mark)

(ii) Explain your answer in **1 c. (i)**.

_____

_____

(2 marks)

Continued/...

2. a. State any **two** major sources of wastes.

_____

_____

(2 marks)

b. Give any **two** advantages of incineration.

_____

_____

(2 marks)

c. Describe a test that can be done to show the presence of oxygen gas.

_____

_____

_____

_____

(4 marks)

3. a. Give any **one** source of sulphur.

_____

(1 mark)

b. Why is it that nitrogen:

(i) reacts with burning magnesium?

_____

_____

(2 marks)

(ii) do not react with burning sulphur?

_____

_____

(2 marks)

c. Give any **three** uses of phosphorous.

_____

_____

_____

(3 marks)

Continued/...

4. a. Describe any **two** chemical properties of alkanals.

_____

_____

_____

_____

(4 marks)

b. Give any **two** uses of alkanals.

_____

_____

(2 marks)

c. Mention any **three** tests that can be used to distinguish propanal from propanol.

_____

_____

_____

(3 marks)

5. a. Define the term esterification.

_____

_____

(1 mark)

b. Given the following equation of a chemical reaction:

$$CH_3CH_2OH\,(l) + CH_3COOH\,(aq) \underset{\longleftarrow}{\xrightarrow{\text{Concentrated. } H_2SO_4}} \mathbf{X} + H_2O(l)$$

(i) Identify product **X.**

_____

(1 mark)

(ii) What is the role of the concentrated H_2SO_4 ?

_____

_____

(1 mark)

Continued/...

6. **Figure 1** shows a structure of an organic compound.

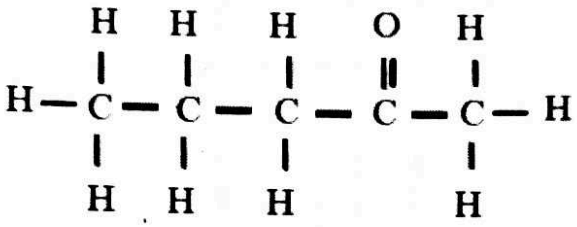

Figure 1

a Name the organic compound shown in **Figure 1**.

_____

_____

(1 mark)

b. Draw any **one** structure of isomers of the compound.

(2 marks)

c. Explain the difference between conformers and isomers.

_____

_____

_____

_____

(2 marks)

7. a. **Figure 2** shows an activity series table. Use it to answer questions that follow.

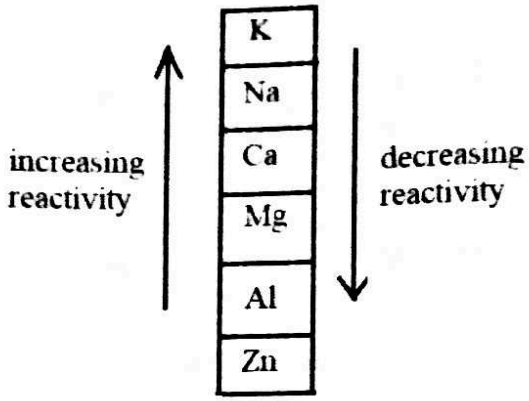

Figure 2

(i) Why is potassium more reactive than zinc?

_____

_____

_____

(2 marks)

(ii) Identify any **two** metals that can displace magnesium from its chloride solution.

_____

_____

(2 marks)

b. (i) Give any **two** examples of endothermic processes.

_____

_____

(2 marks)

(ii) Given the following equation:

$NH_4^+(aq) + H_2O(l) \rightleftharpoons H_3O^+ + NH_3(g)$, identify

1. conjugate acid _____ **(1 mark)**

2. conjugate base _____ **(1 mark)**

Continued ...

8. a. Sodium metal reacts with copper (II) sulphate solution to give sodium sulphate solution and a precipitate of copper according to the following equation:

$$2Na\,(s) + CuSO_4\,(aq) \longrightarrow Na_2SO_4\,(aq) + Cu\,(s).$$

(i) Write down an oxidation half equation for the reaction.

(2 marks)

(ii) Identify a reducing and oxidising agent for the reaction.

Reducing agent: _____ **(1 mark)**

Oxidising agent: _____ **(1 mark)**

b. **Table 2** shows bond energies for some chemical bonds.

Table 2

Bond	Bond energy (KJ/mol)
C = C	611
C – H	413
C – C	346
H - H	436

Calculate the enthalpy change for the following reaction:

$$C_2H_2\,(g) + H_2\,(g) \longrightarrow C_2H_6\,(g)$$

(5 marks)

Continued ...

9. a. Give any **one** health benefit of hard water.

_____

_____

(1 mark)

b. Write any **two** effects of water pollution.

_____

_____

(2 marks)

c. Explain any **two** effective measures of controlling water pollution.

_____

_____

_____

_____

(4 marks)

10. a. State any **two** problems associated with the depletion of ozone layer.

_____

_____

(2 marks)

b. Give any **two** uses of chambers in the laboratory.

_____

_____

(2 marks)

Section B (30 marks)

Answer **all** the questions in this section in the spaces provided.

11. With the aid of well labelled diagrams, describe the difference between thermosoftening plastics and thermosetting plastics.

(10 marks)

Continued/...

12. a. Describe the process of removing water hardness using distillation.

(5 marks)

b. With the aid of a well labelled diagram, describe the procedure of refining impure copper using electrolysis.

(5 marks)

Continued/...

13. a. With the aid of well-balanced chemical equations, describe the **Ostwald process** of preparing nitric acid, HNO_3.

(6 marks)

13. (Continued)

b. How can purity of a substance be determined using melting and boiling points?

(4 marks)