

**SHIRE HIGHLANDS EDUCATION DIVISION****2024 MALAWI SCHOOL CERTIFICATE OF EDUCATION MOCK  
EXAMINATION****CHEMISTRY****Subject Number: M038/I****Tuesday, 26th March****Time Allowed: 2 hours****8:00 – 10:00 am****PAPER I****THEORY****(100 marks)****Instructions**

1. This paper contains 10 printed pages. Please check.
2. Fill in your **Examination Name** and **School** at the top of each page.
3. This paper contains **two** sections, **A** and **B**. In **Section A** there are **ten** short answer questions while **Section B** 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 number of marks for each answer is indicated against each question.
7. In the table provided on this page, **tick** against the number of question you have answered.

Question Number	Tick if answered	Do not write in these columns	
1			
2			
3			
4			
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9			
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11			
12			
13			

**Section A** (70 marks)  
Answer **all** the questions in this section

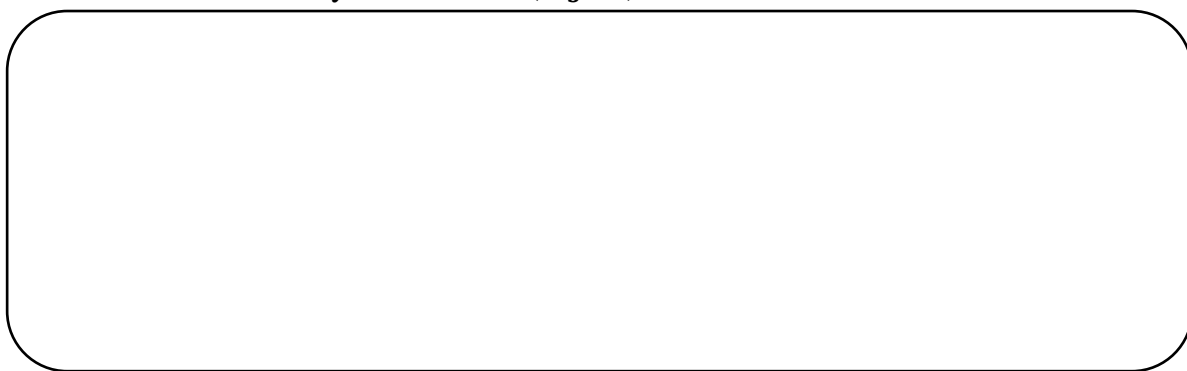
1. a. (i). What is a dative bond?

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(1 mark)

- (ii). Draw the structure of hydronium ion ( $H_3O^+$ ) and label the dative bond



(2 marks)

- b. Give any **one** types of intermolecular force.

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(1 mark)

- c. Explain why the boiling point of water ( $H_2O$ ) is higher than the boiling point of butane( $C_4H_{10}$ )?

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(2 marks)

2. a. Give the value of Avogadro's constant.

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(1 mark)

- b. Calculate the mass (in grams) of oxygen gas contained in  $400\text{cm}^3$  balloon standard temperature and pressure.(Ar: O = 16).



(2 marks)

Continued/...

c. Why is conclusion important at the end of scientific investigation?

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

d. (i). Mention **two** main raw materials for saponification

\_\_\_\_\_  
 \_\_\_\_\_ (2 marks)

(ii). Why is sodium chloride added to the mixture during saponification.

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

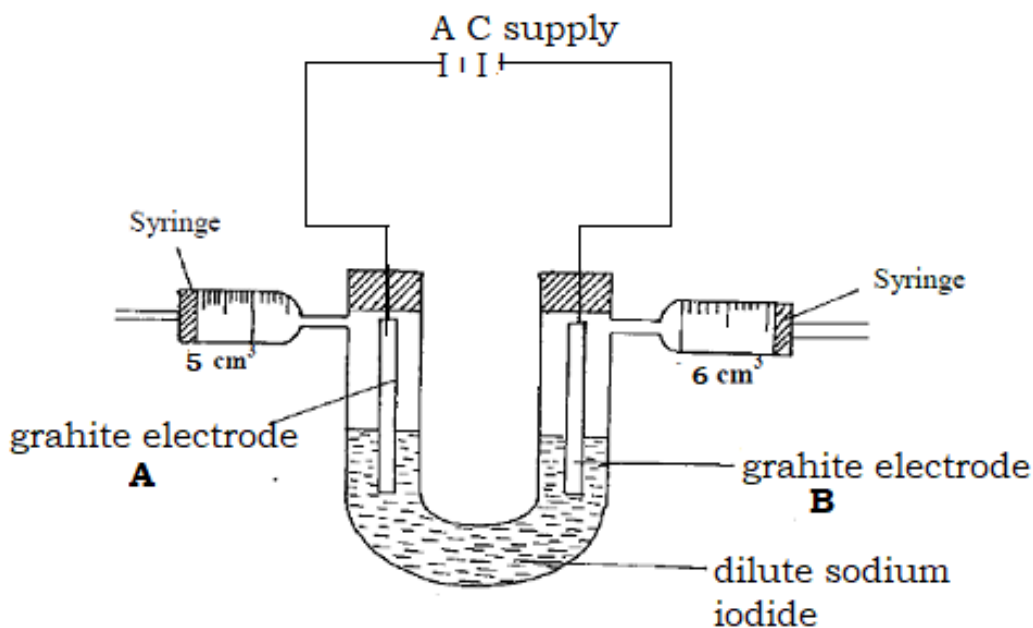
3. a. Define the term electrolysis.

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

b. Mention any **one** factor affecting preferential discharge.

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

c. **Figure 1** shows a process of electrolysis of dilute sodium iodide



**Figure 1**

(i). Identify the gases produced at electrode **A** and **B**

**A** \_\_\_\_\_ (1 mark)

**B** \_\_\_\_\_ (1 mark)

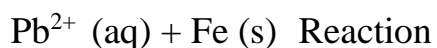
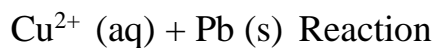
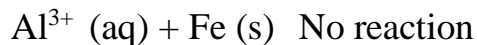
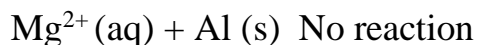
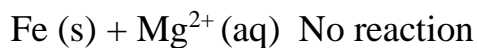
(ii). Write the ionic half equation to show reaction at the electrode **A**.

\_\_\_\_\_  
 \_\_\_\_\_ (2 marks)

(iii). What would happen at the anode electrode if concentrated sodium iodide was used?

\_\_\_\_\_  
 \_\_\_\_\_ (1 mark)

d. Study the chemical equations below



(i) Arrange the elements in order of increasing reactivity.

\_\_\_\_\_ (2 marks)

(ii) Write down the products formed when aluminium metal is dipped in aqueous solution of lead. \_\_\_\_\_ (1 mark)

4. a. Name an acid found in lemons

\_\_\_\_\_ (1 mark)

b. Produce a chemical equation for a reaction given the conjugate acid base pairs:



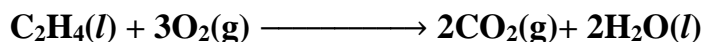
\_\_\_\_\_ (2 marks)

c. Explain the importance of neutralisation reaction in teeth care

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ (2 marks)

d. Excess ethene reacted with **25g** of oxygen (  $3\text{O}_2$ ) as shown in the balanced equation below.

(Ar: C = 12, O = 16, H = 1)



(i) Calculate the theoretical yield of carbon dioxide ( $2\text{CO}_2$ ).

(3 marks)

(ii) Determine the percentage yield if **19.65g** of carbon dioxide was actually obtained.

(2 marks)

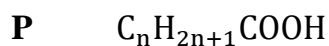
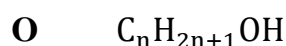
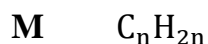
5. a. Name the type of polymerisation where two ethene molecules join.

\_\_\_\_\_ (1 mark)

b. Give **one** use of terylene polymer.

\_\_\_\_\_ (1 mark)

c. Given below are general formulae of some homologous series of organic compounds represented by letters **M**, **N**, **O** and **P**.



(i) Name the homologous series represented by letters **N** and **P**.

**N**     \_\_\_\_\_

**P**     \_\_\_\_\_

(2 marks)

(ii) Identify a homologous series that can oxidise to produce alkanal.

\_\_\_\_\_ (1 mark)

(iii) Why do compounds under homologous series **P** conduct electricity?

\_\_\_\_\_  
\_\_\_\_\_ (1 mark)

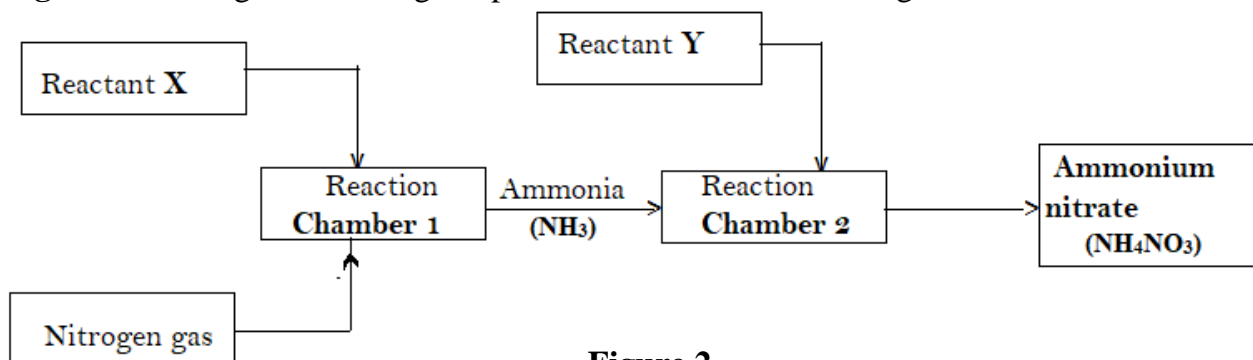
d. Give **one** danger of excessive consumption of alcohol.

\_\_\_\_\_  
\_\_\_\_\_ (1 mark)

6. a. State **two** importance of nitric acid in mining industry.

\_\_\_\_\_  
\_\_\_\_\_ (2 marks)

b. **Figure 2** is a diagram showing the process used in manufacturing of ammonium nitrate.



**Figure 2**

- (i) Name the reactant **Y**.  
 \_\_\_\_\_ (1 mark)
- (ii) State **two** conditions necessary for the reaction to occur in **chamber 1**  
 \_\_\_\_\_  
 \_\_\_\_\_ (2 marks)
- (iii) Suggest **one** use of ammonium nitrate  
 \_\_\_\_\_ (1 mark)

7. a. How does gas pressure affect reaction of gases?

\_\_\_\_\_  
 \_\_\_\_\_ (2 marks)

b. Magnesium ribbon react with sulphuric acid to produce a salt and hydrogen gas. Hydrogen gas was collected in a syringe and its volume increased from **10cm<sup>3</sup>** to **28cm<sup>3</sup>** in just **5** seconds.

- (i) Give the name of salt produced.  
 \_\_\_\_\_ (1 mark)

- (ii) Calculate the rate of hydrogen reaction

(2 marks)

- (iii) Suggest any **one** chemical waste produced from this reaction.  
 \_\_\_\_\_ (1 mark)

8. a. Name the substance responsible for temporary water hardness.

\_\_\_\_\_ (1 mark)

b. How does deforestation disturb the water cycle?

\_\_\_\_\_  
 \_\_\_\_\_(2 marks)

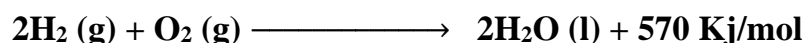
c. Describe how insoluble salts produced by precipitation reaction can be cleaned and purified?

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_(4 marks)

9. a. What is bond energy

\_\_\_\_\_  
 \_\_\_\_\_(1 mark)

b. Hydrogen gas reacts with oxygen gas to produce to produce water and heat as shown in the equation below



(i) What type of heats of reaction is shown in the equation?

\_\_\_\_\_(1 mark)

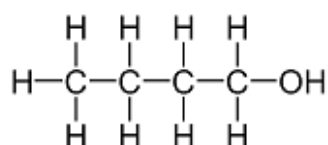
(ii) Give the meaning of (g) in the equation

\_\_\_\_\_(1 mark)

(iii) Draw an energy level diagram for the reaction

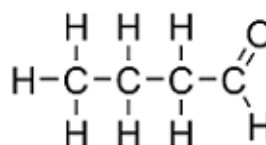
(2 marks)

10. **Figure 3** is a diagram showing structures of organic compounds **J** and **K**



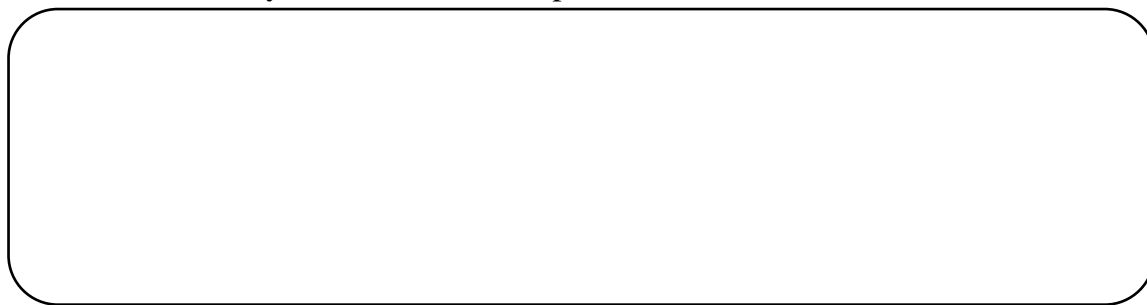
**J**

**Figure 3**



**K**

- a. Name the organic compound **K**.  
\_\_\_\_\_  
(1 mark)
- b. Write a condensed formula of compound **J**.  
\_\_\_\_\_  
(1 mark)
- c. In the presence of a catalyst organic compound **K** undergo reduction to produce compound **J**.  
(i) Name the molecule/compound used in the reduction of compound **K**.  
\_\_\_\_\_  
(1 mark)  
(ii) Name the catalyst in the reaction  
\_\_\_\_\_  
(1 mark)
- d. Draw and name any **one** isomer of compound **K**



(2 marks)

**SECTION B (30 marks)**Answer **all** the questions in this section in the spaces provided.

11. a. Describe how nitrate ion ( $\text{NO}_3^-$ ) can be tested using **brown ring experiment**.

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(4 marks)

- b. Discuss **three** social-economic importance of recycling metals and plastics.

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(4 marks)

[illegible]

(6 marks)

13. Using a well labelled diagram, describe how the strength of nitric acid ( $\text{HNO}_3$ ) and ethanoic acid ( $\text{CH}_3\text{COOH}$ ) can be compared using conductivity test

\_\_\_\_(10 marks)

**END OF QUESTION PAPER**

**NB: This paper contains 10 printed pages**