# THE MALAWI NATIONAL EXAMINATIONS BOARD

## 2021 MALAWI SCHOOL CERTIFICATE OF EDUCATION EXAMINATION

# CHEMISTRY

**Subject Number: M038/I**

**Time Allowed: 2 hours**
**2:00 – 4:00 pm**

**Tuesday, 9 November**

## PAPER I

(100 marks)

**Instructions**

1. **This paper contains 10 printed pages. Please check.**
2. Fill in your **Examination Number** 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 in 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 the question you have answered.

| Question Number | Tick if answered | Do not write in these columns | |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
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| 8 | | | |
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| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |
| | | | |

**SECTION A** (70 marks)

Answer **all** the **ten** questions in this section.

**1.** a. Give any **two** laboratory chemical wastes.

_____

_____

**(2 marks)**

b. Why is it important to formulate hypothesis before conducting the experiment?

_____

**(2 marks)**

c. Describe how anions of sulphide can be identified.

_____

_____

_____

_____

**(6 marks)**

**2.** a. Name any **one** compound that contains dative bonds.

_____

**(1 mark)**

b. Explain why ionic compounds have high melting and boiling points.

_____

_____

_____

_____

**( 3 marks)**

**3.** a. Explain how the inertness of nitrogen gas is used in food processing.

_____

_____

_____

**(2 marks)**

3. **(Continued)**

b. What are the **three** necessary conditions in the production of ammonia?

_____

_____

_____

_____

**(3 marks)**

4. a. How can the pH of soil be reduced?

_____

**(1 mark)**

b. State any **two** uses of precipitation reaction.

_____

_____

**(2 marks)**

c. Give the **three** types of oxides.

_____

_____

_____

**(3 marks)**

5. a. (i) Give any **three** chemical properties of alkanols.

_____

_____

_____

_____

**(3 marks)**

**5.** a. **(Continued)**

(ii) Complete the following chemical equation:

$CH_3CH_2OH + CH_3COOH \longrightarrow$ _____ $+ H_2O$

**(1 mark)**

b. (i) State any **two** uses of alkanols.

_____

_____

**(2 marks)**

(ii) Complete the following chemical equation for reaction between ethanol and sodium metal:

$CH_3CH_2OH + Na \longrightarrow$ _____ + _____ .

**(2 marks)**

c. HO-A-B-A-B-H is a polymer of a polymerization process.

(i) What type of polymerization was involved during the process?

_____

**(1 mark)**

(ii) Name the other product formed during the process mentioned in **5 c (i)**.

_____

**(1 mark)**

**6.** a. Three samples of water **A**, **B** and **C** were tested in the laboratory. The results are shown in the table.

| | SAMPLE | | |
|---|---|---|---|
| **Test** | **A** | **B** | **C** |
| Shaken with soap solution | Poor lather | Good lather | Poor lather |
| Boiled first and shaken with soap solution | Good lather | Good lather | Poor lather |
| Adding $Na_2CO_3$ and shaken with soap solution | Good lather | Good lather | Good lather |

(i) Which of the samples is soft water?

_____

**(1 mark)**

**6.** a. **(Continued)**

(ii) Give a reason for the answer in **6 a (i)**.

_____

**(1 mark)**

(iii) Which sample contained permanent water hardness? Explain your answer.

_____

_____

_____

**(2 marks)**

b. Explain any **two** negative effects of hard water in everyday life.

_____

_____

_____

**(4 marks)**

7. **Figure 1** shows a diagram on how ethanol is produced in a laboratory.

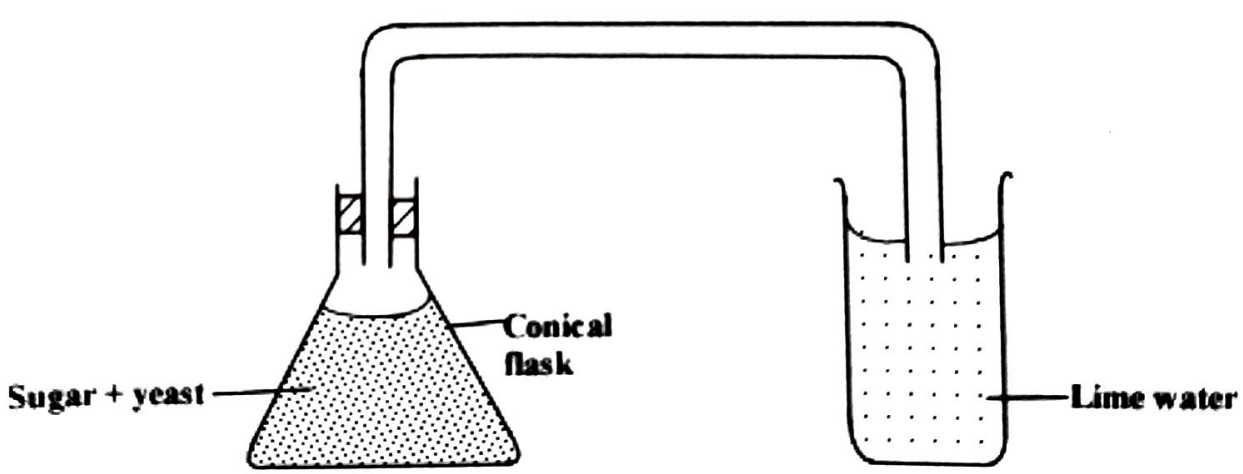


**Figure 1**

a. What is the role of yeast in this process?

_____

**(1 mark)**

7. **(Continued)**

b. What will happen to the lime water after some days? Explain your answer.

_____

_____

**(2 marks)**

c. Write down a balanced equation for the process in the flask.

**(3 marks)**

**8.** a. Define 'rate of reaction'.

_____

_____

**(1 mark)**

b. The equation for the reaction between iron and sulphuric acid to produce iron sulphate and hydrogen gas is as follows:

$$Fe(s) + H_2SO_4(aq) \longrightarrow FeSO_4(aq) + H_2(g)$$

(i) What does the symbol (s) mean?

_____

**(1 mark)**

(ii) What will happen to the rate of reaction if the particles of iron are crushed further?

_____

**(1 mark)**

(iii) Explain your answer in **8 b (ii)**.

_____

_____

_____

**(2 marks)**

Continued/...

**8.** b. **(Continued)**

(iv) Apart from crushing the iron particles, what else could be done to change the rate of reaction?

_____

**(1 mark)**

**9.** a. An organic compound has the following general formula: $C_nH_{2n+1}OH$

(i) Name the functional group of the compound .

_____

**(1 mark)**

(ii) Write down the molecular formula for the compound with 5 carbon atoms.

_____

**(1 mark)**

(iii) Write down any **two** structural isomers of butanol, $C_4H_9OH$ .

**(2 marks)**

b. **Figure 2** shows structures of compounds **P, Q, R** and **S**.

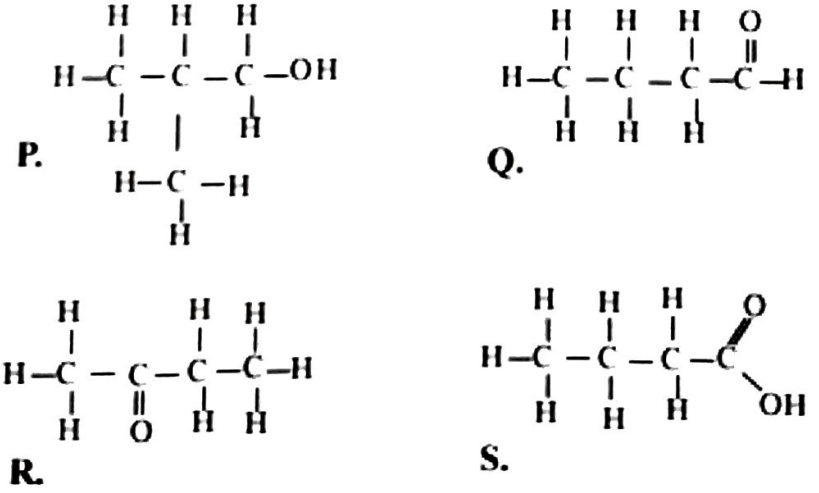


**Figure 2**

(i) Name compounds **Q** and **S**.

**Q:**_____

**S:**_____

**(2 marks)**

Continued/...

**9.** b. **(Continued)**

(ii) Explain the test that can be used to distinguish **R** and **Q**.

_____

_____

_____

**(3 marks)**

c. Name the compound formed when **P** reacts with **S**.

_____

**(1 mark)**

**10.** a. What are greenhouse gases?

_____

_____

**(1 mark)**

b. Give **two** ions that cause water hardness.

_____

_____

**(1 mark)**

c. Briefly explain how flooding affects levels of carbon dioxide in the atmosphere.

_____

_____

_____

_____

**(3 marks)**

**Section B** (30 marks)

Answer **all** the **three** questions in this section.

**11.** a Describe how a polar covalent bond is formed.

_____

_____

_____

_____

_____

_____

**(5 marks)**

**11. (Continued)**

b. Explain why graphite conducts electricity while diamond does not conduct electricity.

**(5 marks)**

**12.** a. Describe how an insoluble salt of lead sulphate ($PbSO_4$) can be prepared from lead nitrate [$(Pb\ (NO_3)_2$] and hydrogen sulphate ($H_2SO_4$) using precipitation method.

**(6 marks)**

b. With the aid of chemical equations, describe the Contact process i.e. the process of manufacturing of sulphuric acid.

**(4 marks)**

Continued/...

2021

13. Describe an experiment that could be done to determine the concentration of hydrochloric acid (HCl) using 20 ml of 0.3M sodium hydroxide (NaOH) solution[Ar: Na = 23, 0 = 16, H = 1, Cl =35].

(10 marks)

# END OF QUESTION PAPER

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