



**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**  
**SCHOOL OF BIOLOGICAL, PHYSICAL, MATHEMATICS AND ACTUARIAL SCIENCES**  
**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**(PUBLIC AND COMMUNITY HEALTH)**  
**1<sup>ST</sup> YEAR 1<sup>ST</sup> SEMESTER 2022**

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**COURSE CODE: SCH 3111**

**COURSE TITLE: PHYSICAL CHEMISTRY**

**EXAM VENUE:**

**STREAM: (BSc. Public & Commu. Health)**

**DATE:**

**EXAM SESSION:**

**TIME: 2:00 HRS**

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**Instructions:**

- 1. Answer question 1 (Compulsory) in Section A and ANY other 2 questions in Section B.**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room**

**Useful data**

Molar mass Ca = 40 g.mol<sup>-1</sup>

Molar mass N<sub>2</sub> = 28 g.mol<sup>-1</sup>

Molar mass O<sub>2</sub> = 32 g.mol<sup>-1</sup>

Molar mass NH<sub>3</sub> = 17.03 g.mol<sup>-1</sup>

Molar mass H<sub>2</sub> = 2 g.mol<sup>-1</sup>

Molar mass of C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> = 180.2 g.mol<sup>-1</sup>

Molar mass of H<sub>2</sub>O = 18 g.mol<sup>-1</sup>

**INSTRUCTIONS: Answer Question 1 and any other TWO questions**

**QUESTION ONE (30 marks)**

- (a) Define the following;
- (i) Chemical change
  - (ii) Electrode
  - (iii) Le Chatelier's principle
  - (iv) Daltons law of partial pressure
  - (v) Oxidation number
  - (vi) Reaction quotient [12 marks]
- (b) 0.25 moles of ammonia were found to occupy 1.30 litres at 50 °C. Calculate the pressure if the gas behaves as an ideal gas. [4 marks]
- (c) Hydrogen gas is prepared as per the following chemical equation;
- $$\text{HNO}_3 \text{ (aq)} + \text{Ca} \text{ (s)} \rightarrow \text{Ca(NO}_3\text{)}_2 \text{ (aq)} + \text{H}_2 \text{ (g)}$$
- Balance and calculate the amount of Magnesium in kilograms required to prepare 2 L of H<sub>2</sub> gas at 750 mmHg and 50 °C. [7 marks]
- (d) What is the percentage yield of H<sub>2</sub>O if 130 g of H<sub>2</sub>O is produced from 16 g H<sub>2</sub> and 10 g O<sub>2</sub>? [7 marks]

**QUESTION TWO (20 marks)**

- (a) The equilibrium constant for the reaction below is 0.2.
- $$2\text{HF}_{(g)} \leftrightarrow \text{H}_{2(g)} + \text{F}_{2(g)}$$
- At equilibrium, 2 moles of hydrogen and 1 mole of fluorine were present in a 1 L vessel at 400 °C. What is the concentration of the hydrogen fluoride present at equilibrium? [4 marks]
- (b) Discuss any **THREE** factors affecting the chemical equilibrium in a system. [6 marks]
- (c) A solution contains 2.65 g of glucose, C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> dissolved in 14.2 g of water. What are the mole fractions of glucose and water? [6 marks]
- (d) Define the term reaction quotient and equilibrium constant as used in chemical equilibria. [4 marks]

**QUESTION THREE (20 marks)**

- (a) Classify the following as either physical or chemical changes:

- (i) The evaporation of alcohol
  - (ii) Carbon dioxide gas extinguishes fire
  - (iii) Crushing a panadol tablet [3 marks]
- (b) Derive the ideal gas equation from basic gas laws. [6 marks]
- (c) Electrochemical cells are widely used in day-to-day applications and are broadly classified into voltaic or electrolytic cells. Define these types of cells. [4 marks]
- (d) 1.0 g of air consists of approximately 0.78 g of nitrogen and 0.22 g of oxygen. Calculate the total pressure when this sample occupies a 3.00 L vessel at -20 °C. [7 marks]

#### QUESTION FOUR (20 marks)

- (a) Identify the oxidizing and reducing agent in the following redox reaction  

$$\text{Cr}_2\text{O}_7^{2-} + \text{I}^- \rightarrow \text{Cr}^{3+} + \text{IO}_3^-$$
 [4 marks]
- (b) Insulin is a hormone that controls the use of glucose in the body. How many moles of insulin are required to make 24.0 mL of a 0.0036 M insulin solution? [3 marks]
- (c) Assign oxidation number to the underlined atoms in;  
 $\underline{\text{N}}\text{O}_3^-$ ,  $\underline{\text{S}}\text{O}_4^{2-}$  and  $\text{H}_2\underline{\text{As}}\text{O}_3^-$  [6 marks]
- (d) Olive leaves produces oil with a density of 0.65 g/L at 20 °C at a pressure of 70 Torr. Calculate the molecular weight of the eucalyptus oil. [5 marks]
- (e) Give any **TWO** applications of electrochemistry. [2 marks]

#### QUESTION FIVE (20 marks)

- (a) Balance the following reaction equations:
- (i)  $\text{Fe} + \text{O}_2 \rightarrow \text{Fe}_2\text{O}_3$  [2 marks]
  - (ii)  $\text{C}_6\text{H}_6 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$  [2 marks]
- (b) Distinguish the following terms:
- (i) Gas and a liquid
  - (ii) Reduction and Oxidation
  - (iii) Effusion and diffusion
  - (iv) Molarity and molality
  - (v) Saturated and supersaturated solution [10 marks]
- (c) Explain the meaning of the term ‘colligative property’ and give its properties. [6 marks]