**JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES**

**UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE**

**(PUBLIC & COMMUNITY HEALTH)**

**1ST YEAR 1ST SEMESTER 2018/2019**

# KISUMU CAMPUS

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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**

a = 4.17 $L^2$ atm.$mol^{-2}$
b = 0.0371 L.$mol^{-1}$
R= 0.0821 L atm. $K^{-1}mol^{-1}$
Molar mass Mg = 24 g.$mol^{-1}$
Molar mass $N_2$ = 28 g.$mol^{-1}$
Molar mass $O_2$ = 32 g.$mol^{-1}$
Molar mass $NH_3$ = 17.03 g.$mol^{-1}$
Molar mass $H_2$ = 2 g.$mol^{-1}$
Molar mass of glucose = 180.2 g.$mol^{-1}$

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

## QUESTION ONE (30 marks)

1. (a) Define the following;
   (i) Equilibrium constant
   (ii) Chemical change
   (iii) Electrolyte
   (iv) Voltaic cells
   (v) Effusion
   (vi) Ideal gas equation [12 marks]

   (b) 3.25 moles of ammonia was found to occupy 1.30 litres at 50 °C. Calculate the pressure that would be expected if the gas behaves as a real gas. [6 marks]

   (c) Hydrogen gas is prepared as per the following chemical equation;

   $HNO_{3\,(aq)} + Mg_{\,(s)} \rightarrow Mg(NO_3)_{2\,(aq)} + H_{2\,(g)}$

   Balance and calculate the amount of Magnesium in kilograms required to prepare 2 L of $H_2$ gas at 750 mmHg and 30 °C. [6 marks]

   (d) What is the percentage yield of $H_2O$ if 138 g of $H_2O$ is produced from $H_2$ and excess $O_2$? [6 marks]

## QUESTION TWO (20 marks)

2. (a) Derive the ideal gas equation from basic gas laws. [6 marks]

   (b) What is a redox reaction? Explain using an example. [3 marks]

   (c) 1.0 g of air consists of approximately 0.72 g of nitrogen and 0.28 g of oxygen. Calculate the total pressure when this sample occupies a 2.00 L vessel at 20 °C. [7 marks]

   (d) Classify the following as either physical or chemical changes:
   (i) The evaporation of alcohol
   (ii) Oxygen gas supports combustion
   (iii) Crushing a panadol tablet
   (iv) Photosynthesis [4 marks]

## QUESTION THREE (20 marks)

3. (a) Give any **TWO** applications of electrochemistry. [2 marks]

(b) Identify the oxidizing and reducing agent in the following redox reaction [4 marks]

$Cr_2O_7^{2-} + I^- \rightarrow Cr^{3+} + IO_3^-$

(c) Insulin is a hormone that controls the use of glucose in the body. How many moles of insulin are required to make 28.0 mL of a 0.0048 M insulin solution? [3 marks]

(d) Assign oxidation number to the underlined atoms in;
$\underline{N}O_3^-$, $SO_4^{2-}$ and $H_2AsO_3^-$ [6 marks]

(e) Eucalyptus leaves produces oil with a density of 0.4 g/L at 20 °C at a pressure of 700 Torr. Calculate the molecular weight of the eucalyptus oil. [5 marks]

**QUESTION FOUR (20 marks)**

4. (a) Balance the following reaction equations:

(i) $Fe + O_2 \rightarrow Fe_2O_3$ [2 marks]

(ii) $C_6H_6 + O_2 \rightarrow CO_2 + H_2O$ [2 marks]

(b). Distinguish the following terms:

(i) Gas and a liquid
(ii) Reduction and Oxidation
(ii) Real gas and Ideal gas
(iv) Saturated and supersaturated solution
(v) Oxidation number and Oxidation [10 marks]

(c) Explain the meaning of the term 'colligative property' and give its properties. [6 marks]

**QUESTION FIVE (20 marks)**

5. (a) The equilibrium constant for the reaction below is 0.2.

$2HF \leftrightarrow H_{2(g)} + F_{2\ (g)}$

2 moles of hydrogen and 1 mole of iodine were mixed in a 1 L vessel at 400 °C. What are the concentrations of the species present at equilibrium? [4 marks]

(b) Discuss the **FOUR** factors affecting the chemical equilibrium in a system. [8 marks]

(c) State the Le Chatelier's Principle [2 marks]

(d) A solution contains 2.75 g of glucose, $C_6H_{12}O_6$ dissolved in 15.2 g of water. What are the mole fractions of glucose and water? [6 marks]