JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

PUBLIC HEALTH AND COMMUNITY HEALTH & DEVELOPMENT

1ST YEAR 1ST SEMESTER 2016/17

KISUMU LEARNING CENTRE

COURSE CODE: SCH 3111

COURSE TITLE: PHYSICAL CHEMISTRY

EXAM VENUE: **STREAM: (BSC. PUB. & COMMU. HEALTH & DEV.)**

DATE: **EXAM SESSION:**

TIME: 2:00 HRS

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.**

INSTRUCTIONS: Answer Question 1 and any other TWO questions

QUESTION ONE (30 marks)

1. (a) Define the following;
   (i) Grahams law of effusion
   (ii) Ideal gas
   (iii) Oxidation as used in electrochemistry
   (iv) Dalton's law of partial pressure
   (v) Boyle's law
   (vi) Avogadro's law [12 marks]

   (b) Two moles of carbon dioxide was found to occupy 1.32 litres at 50 °C and a pressure of 18.40 atms. Calculate the pressure that would have been expected;
   (i) From the equation of state [3 marks]

   (ii) From the Van der Waal's equation (a = 6.70 L^2 $atm.mol^{-2}$, b = 5.6 x 10^{-2} $L.mol^{-1}$, R= 0.082 L atm. $K^{-1}mol^{-1}$). [7 marks]

   (c) Discuss how each of the following factors affect equilibrium in relation to the Le Chatelier's principle:
   (i) Temperature
   (ii) Pressure
   (iii) Concentration
   (iv) Catalyst [8 marks]

QUESTION TWO (20 marks)

2. (a) Write down the Van der Waal's equation of a real gas. [2 marks]

   (b) Explain clearly the meaning of the corrective terms for

   (i) Pressure
   (ii) Volume [4 marks]

   (c) 1.0 g of air consists of approximately 0.8 g of nitrogen and 0.2 g of oxygen. Calculate the partial pressures and the total pressure when this sample occupies a 2.00 L vessel at 20 °C. [7 marks]

   (d) Consider the following reaction

   $CO_{2\,(g)} + H_{2\,(g)} \leftrightarrow CO_{(g)} + H_2O_{(g)}$

   Calculate the equilibrium constant, K_c for the above system if 0.1908 moles of CO_2, 0.0908 moles of H_2, 0.0092 moles of CO and 0.0092 moles of H_2O were present in a 2.00 L reaction vessel at equilibrium. [4 marks]

   (e) One mole of an ideal gas occupies 12 Litres at 25 °C. What is the pressure of the gas? [3 marks]

QUESTION THREE (20 marks)

3. (a) Hydrogen gas is prepared by reacting Magnesium with hydrochloric acid as per the following chemical equation; $2HCl_{(aq)} + Mg_{(s)} \rightarrow MgCl_{2\,(aq)} + H_{2\,(g)}$
Calculate the amount of Magnesium in kilograms required to prepare 2.00 L of H_2 gas at 1 atm and 30 °C. [6 marks]

(b) The state of a gas is defined by 4 variables. Name them. [4 marks]

(c) State the FIVE postulates of the kinetic theory of gases. [10 marks]

QUESTION FOUR (20 marks)

4. (a) Define the term reaction quotient and equilibrium constant as used in chemical equilibria. [4 marks]

(b) For the reaction; $SO_{2\,(g)} + NO_{2\,(g)} \leftrightarrow SO_{3\,(g)} + NO_{(g)}$, $K_c = 9.00$ at 973 K. If 1.00 mole of SO_3 and 1 mole of NO are injected into a 1.00 litre flask at 973 K. Predict the direction in which the reaction would proceed with reasons. [2 marks]

(c)Define colligative property of a solution and give its properties. [6 marks]

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

(ii) Consider the following equation
$N_{2\,(g)} + 3H_{2\,(g)} \leftrightarrow 2\,NH_{3\,(g)}$
What is the effect of increasing pressure to this equation? [3 marks]

(e) A weather balloon has a volume of 175 L when filled with hydrogen at a pressure of 1 atm. Calculate the volume of the balloon when it rises to a height of 2000 m, where the atmospheric pressure is 0.80 atm. Assume the temperature is constant. [3 marks]