JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF:

BACHELOR OF EDUCATION SCIENCE WITH IT

BACHELOR OF BIOLOGICAL SCIENCES
1ST YEAR 1ST SEMESTER 2016/2017 ACADEMIC YEAR

MAIN CAMPUS

COURSE CODE: SCH 101/3111

COURSE TITLE: BASIC PHSICAL CHEMISTRY

EXAM VENUE: AH   **STREAM: (BED Sc.)**

DATE: 22/04/16   **EXAM SESSION: 2.00 – 4.00 PM**

TIME: 2 HOURS

Instructions:

1. Answer question 1 (compulsory) and ANY other 2 questions.
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.

Question 1

a) Discuss how each of the following factors affect equilibrium in relation to the
   Le Chaterlier's Principle: (8 marks)
   - (i) Temperature
   - (ii) Pressure
   - (iii) Concentration
   - (iv) Catalysis

b) State the **FIVE** postulates of the Kinetic theory.   (10 marks)

c) Explain how any **FOUR** factors affect the kinetics of chemical processes. (8 marks)

d) Consider the following reaction;

$$CO_2(g) \ + \ H_2(g) \ \rightleftharpoons \ CO(g) \ + \ H_2O(g)$$

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 vapour were present in a 2.00 L reaction vessel at equilibrium.   (4 marks)

Question 2

a) In how what volume water should 10g of glucose ($C_6H_{12}O_6$) be dissolved to obtain a solution freezing at -0.35°C? (f = 18.6 K for 100 g of water).   (5 marks)
b) Discuss the solid state of aggregation with respect to;   (9 marks)
    (i) Compactness
    (ii) Molecular motions
    (iii) Cohesion
c) Briefly discuss the significance of studying chemical kinetics.   (6 marks)

Question 3

a) Distinguish the following terms: (6 marks)

   (i) Ideal and real gas
   (ii) Chemical and phase equilibrium
   (iii) Reactant and reagent

b) 5 moles of ethanol, 6 moles of ethanoic acid, 6 moles of ethylacetate and 4 moles of water were mixed together in a stoppered bottle at 15°C. After equilibrium was attained, the bottle was found to contain only 4 moles of the acid.
    (i)   Write the chemical equation for the reaction.   (2marks)
    (ii)   Give the expression for the equilibrium constant for the reaction. (2 marks)
    (iii) How many moles of ethanol, ethylacetate and water were present in the equilibrium mixture? Explain your answer.   (2 marks)
    (iv)   If 1 mole of ethylacetate was added after the equilibrium was established, what would happen?   (2 marks)
    (v)   Explain the term "dynamic equilibrium".   (2 marks)
c) Briefly discuss any **FOUR** classes of chemical reactions.   (4marks)

Question 4

a)   Define the following terms;   (10 marks)
(i)   Equilibrium constant
(ii)   Reversible reaction
(iii) Order of a reaction
(iii) Rate law
(iv)   Molecularity

b) Liquid camphor freezes at 175°C. A solution of 1.54 g of naphthalene ($C_{10}H_8$) in 18 g of camphor freezes at 148.3 °C. What is the freezing point constant of camphor.   (4 marks)

c) The equilibrium constant for the reaction below is 0.02.

$$2HI \rightleftharpoons H_{2(g)} + I_{2(g)}$$
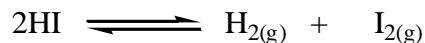
2 moles of hydrogen and 1 mole of iodine were mixed in a 1 dm^3 vessel at 440°C. How many moles of hydrogen iodide, hydrogen and iodine were present at equilibrium? (6 marks)

Question 5

a) Distinguish the following pairs of terms; (6 marks)
   (i) Rate Law and rate constant
   (ii) Oxidation and reduction as used in electrochemistry
   (iii) Reaction and Gas stoichiometry

b) (i) Show that for the reaction; (2 marks)
$$A \longrightarrow B; \quad \text{Rate is } -\frac{d[A]}{dt}$$
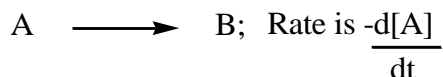
c) 707 cm^3 of an unknown gas diffuses through a porous plug within the same time as it takes 250 cm^3 of oxygen to diffuse under the same conditions of pressure and temperature. Calculate the relative molecular mass of the unknown gas.
(Hint; RMM of O$_2$ = 32). (4 marks)

d) Show that; (4 marks)
$$K_p = K_c [R]^{\Delta n}$$

e) One mole of an ideal gas occupies 12 Liters at 25°C. What is the pressure of the gas? (4 marks)

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