JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES

FIRST YEAR FIRST SEMESTER EXAMINATIONS FOR THE DEGREE OF BACHELOR OF SCIENCE IN AGRICULTURAL EXTENSION AND EDUCATION

SCH 3111: BASIC PHYSICAL CHEMISTRY

UNIVERSITY EXAMINATIONS: 2017/2018 ACADEMIC YEAR

ANSWER ALL QUESTIONS IN SECTION A AND ANY TWO QUESTIONS IN SECTION B

Question 1

a) State and explain any **FIVE** postulates of the Kinetic theory. (10 marks)

b) If P_1, V_1 and T_1 are the values of pressure, volume and temperature respectively for any definite quantity of gas, and P_2, V_2 and T_2 are another set of desired conditions, show that

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

(5 marks)

c) If one mole of an ideal gas occupies 12 Liters at 25°C. What is the pressure of the gas? (5 marks)

d) (i) Explain the meaning of the term "colligative properties" and give three examples. (5 marks)

(ii) In how much 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)

SECTION B: ANSWER ANY TWO QUESTIONS FROM THIS SECTION-EACH QUESTION CARRIES 20 MARKS

Question 2

a) Define the following terms; (10 marks)

(i) Equilibrium constant
(ii) Reversible reaction
(iii) Order of a reaction
(iii) Rate law
(iv) Molecularity

b) What is a redox reaction? Explain using an example. (5 marks)

c) The lowering of vapour pressure of a solution of 108.2 g of a substance X in 1 Kg of water at 20°C is 24.79 Nm^{-2}. The vapour pressure of water at this same temperature is 2.338 kNm^{-2}. Calculate the RMM of X. (5 marks)

Question 3

a) Two flasks of equal volumes are connected by a narrow tube of negligible volume. Initially, both flasks are at 27°C and contain 0.70 moles of H_2 gas, the pressure being 0.50 atmospheres. One of the flasks is then immersed in a hot oil bath at 127°C while the other is kept at 27°C. Calculte the final pressure and the moles of H_2 in each flask. (10 marks)

b) Distinguish the following terms; (6 marks)
   (i) Electrolysis and Electrochemistry
   (ii) Anode and cathode
   (iii) Electrolytic and galvanic/voltaic cell

c) When 1 mole of HI is allowed to dissociate in 1.0 dm^3 vessel at 440°C, only 0.78 moles of HI are present at equilibrium. What is the equilibrium constant at this temperature for this reactiom? (4 marks)

Question 4

a) The equilibrium constant for the reaction below at 298K is 200 $mol^{-1}dm^3$.

$$2NO_2(g) \rightleftharpoons N_2O_4(g)$$

   (i) Write the expression for the equilibrium constant for the reaction. (3 marks)
   (ii) If the $[NO_2]$ in the equilibrium mixture at this temperature is 2×10^{-2} mol dm^{-3}, what is the $[N_2O_4]$? (3 marks)
   (iii) Calculate the equilibrium constant for this reaction at 298K. (3 marks)

d) 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. What is the freezing point constant of camphor. (5 marks)

e) Distinguish the following terms; (6 marks)
   (i) Electrolysis and Electrochemistry
   (ii) Anode and cathode
   (iii) Electrolytic and galvanic/voltaic cell

Question 5

a) 2.0 g of phosphorus elevated the boiling point of 37.4g of carbon disulphide by 1.003°C. What is the molecular formula of phosphorus in CS_2 ? (M = 31 g for P; b = 2.35°C for 1 mole of P in 1000 g of CS_2) (6 marks)

b) State and explain any **FOUR** factors that influence the rate of a chemical reaction.(8 marks)

c) Sketch the isobar and the isotherm that defines Charles' and Boyle's laws respectively and show the trend in Temperature and pressure respectively (6 marks)

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