



Technical University of Mombasa

Faculty Of Applied and Health Sciences

DEPARTMENT OF **PURE AND APPLIED SCIENCES**
SPECIAL/SUPPLEMENTARY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN INDUSTRIAL
MICROBIOLOGY AND BIOTECHNOLOGY AND BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY
SCH 2102 / ACH 4106: PHYSICAL CHEMISTRY I

Series: October 2013

Time: 2 hours

Instructions

The paper has **FIVE** questions. Answer questions **ONE** and any other **TWO** questions

Question ONE

- (a) In a blend of two propellants, 40grams of A was mixed with 80grams of B grams of B. The molecular weight and vapour pressure of A are 120.93 and 86 Pascal respectively. While that of B are 137.38 and 18 Pascal respectively. Calculate the total vapour pressure of propellant. (6marks)
- (b) A buffer was prepared by mixing ammonia and ammonium chloride solutions. Explain how this buffer will behave when
- Acid is added
 - Base is added
- (c) Explain briefly deviation of gases at high pressure (4marks)
- (d) Derive ionic product of water (4marks)
- (e) Calculate the partial pressure of Chlorine in the following equilibrium reaction mixture
- $$\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \quad K_p = 1.05 \text{ at } 300\text{k}$$

(4marks)

Given the equilibrium partial pressure of PCl_5 and PCl_3 as 0.875 and 0.463 atmospheric respectively. (4marks)

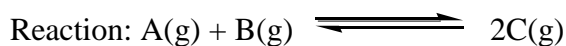
(f) Differentiate between:-

- Ideal and non ideal solution

- ii) Standard enthalpy of hydration and lattice energy (9marks)

Question TWO

- a) 0.25 moles of A was mixed with 0.45 moles of B and allowed to react to form C. At equilibrium there were 0.16 moles of C in 1 liter vessel.

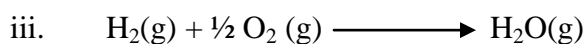


Calculate:-

- i. Equilibrium constant K_x
 - ii. Equilibrium constant K_c
 - iii. Equilibrium constant K_p if total pressure were 2 atmp. (11marks)
- b) Define Arrhenius acid (2marks)
- c) State:-
- i. Limitation of Bronsted-Lowry Theory
 - ii. Success of Arrhenius theory (4marks)
- d) Explain how temperature and stirring affect rate of solubility (3marks)

Question THREE

- (a) Calculate the molar enthalpy of formation of Butane from its elements using the following thermo chemical equations



The overall equation for the



- (b) 230grams of sodium chloride was dissolved in water. The density of this solution at 25°C was 1200grams per liter. Calculate
- i. Molality of this solution
 - ii. Mass percent of water. (6marks)
- (c) Calculate the PH of a buffer solution containing 0.8M Acetic acid and 0.3M sodium acetate given ionization constant of acid as 1.819×10^{-5} (4marks)
- (d) Explain how temperature and stirring affect rate of solubility (3marks)

Question FOUR

- a) The solubility of CuBr is found to be 2.0×10^{-4} mol/liter at 25°C . Calculate the solubility product K_{sp} of CuBr (4marks)
- b) 48.6 grams of Ammonia occupy a volume of 5.4 L at 45°C . using van der Waals equation calculate pressure it will exert. (given $a = 138.9\text{Kpa L}^2/\text{mol}^2$, $b = 0.0371\text{ L/mol}$, $R = 0.8314\text{ pa m}^3/\text{k.Mol}$) (6marks)
- c) State Le Chatelier's principle (2marks)
- d) Ethanol-water system shows negative deviation while Nitric acid-water system shows positive deviation from Raoult's law. Sketch boiling point-composition diagram for the above azeotropic system. (8marks)

Question FIVE

- (a) Nitrogen was reacted with hydrogen to form ammonia. (2marks)
- $$\text{Reaction } \text{N}_2(\text{g}) \rightleftharpoons 2\text{NH}_3 \quad \Delta H = -92.2 \text{ KJ}$$
- Using Le Chatelier's principle, predict the direction of equilibrium if:-
- Pressure is decrease
 - Volume is decrease
 - Temperature is increase
 - Concentration of $\text{NH}_3(\text{g})$ withdrawn (4marks)
- (b) Differentiate between acid salt and basic buffer (3marks)
- (c) The decomposition of dinitrogen pentoxide is of first order reaction with rate constant of $4.8 \times 10^{-4} \text{ sec}^{-1}$ at 50°C . If the initial concentration was 0.45M, calculate
- Concentration after 3.2 minutes
 - Time it will take for concentration to reduce to 0.15M (8marks)
- (d) Calculate the value and its universal constant for one mole of a gas at S.T.P (273 Kelvin and 760mmHg) (3marks)
- (e) Define thermodynamic equilibrium (2marks)