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

i. Acid is added

ii. 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

$PCL_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ Kp = 1.05 at 300k

(4marks)

Given the equilibrium partial pressure of PCl5 and PCl3 as 0.875 and 0.463 atmospheric respectively. *(4marks)*

(f) Differentiate between:-

i) 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 0.45moles of B and allowed to react to form C. At equilibrium there were 0.16moles of C in 1 liter vessel.

Reaction: $A(g) + B(g) \rightleftharpoons 2C(g)$

Calculate:-

i. Equilibrium constant Kx

ii. Equilibrium constant Kc

iii. Equilibrium constant Kp 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

i. $C_4H_{10}(g) + 6.5O_2 \longrightarrow 4CO_2(g) + 5H_2O(g)$ $\Delta H = -2657.4Kj/mol$

ii. $Cs + Og \longrightarrow CO2(g)$ $\Delta Hcomb = -393.5Kj/mol$

iii. $H_2(g) + ½\ O_2\ (g) \longrightarrow H_2O(g)$

The overall equation for the

$C(s) + H_2\ (g) \longrightarrow C_4H_{10}(g)$ *(5marks)*

(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 Ksp of CuBr *(4marks)*

b) 48.6 grams of Ammonia occupy a volume of 5.4 L at 45˚C. using van deer walls equation calculate pressure it will exert. (given a = 138.9Kpa L^2/mob, b =0.0371 L/mol R= 0.8314 pa m^3/k.Mol *(6marks)*

c) State Le chateliers principle *(2marks)*

d) Ethanol-water system shows negative deviation while Nitric acid-water system shows positive deviation from Raoult law sketch boiling point-composition diagram for the above azeotropic sustem. *(8marks)*

Question FIVE

(a) Nitrogen was reacted with hydrogen to form ammonia. *(2marks)*

Reaction $N_2(g)$ $\rightleftharpoons$ $2NH_3$ ΔH = -92.2 Kj

Using le chatelelier principle predicts direction of equilibrium if:-

i. Pressure is decrease

ii. Volume is decrease

iii. Temperature is increase

iv. Concentration of $NH_3(g)$ 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 4.8×10^{-4} sec^{-1} at 50˚C. If the initial concentration was 0.45M, calculate

i. Concentration after 3.2 minutes

ii. Time it will take for concentration to reduce to 0.15M *(8marks)*

(d) Calculate the value and its of universal constant for one mole of a gas at S.T.P (273 Kelvin and 760mmHg) *(3marks)*

(e) Define thermodynamic equilibrium *(2marks)*