Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4106 : PHYSICAL CHEMISTRY I

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 2013 SERIES   2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions
Answer question **ONE** (compulsory) and any other **TWO** questions

Question ONE

a) Differentiate between ideal and nonideal solution   **(4marks)**

b) Mixture of propanone and trichloromethane shows negative deviation from Roult Law sketch and label   **(4marks)**

    (i)   Pressure – composition curves

    (ii)   Boiling point – Composition curves

c) Explain how temperature affect rate of solubility.   **(3marks)**

d) 3.1grams of urethane was dissolved in 68.44 grams of methanol CH_3OH raised the boiling point by $0.32°C$. Given ebuliscopic constant as $0.88Km^{-1}$ Calculate: **(6marks)**

    (i)   Rmm of urethane

    (ii)   Mole fraction of urethane

(iii)   Vapour pressure of solution given vapour pressure of methane as 23.48mmHg

e)   Calculate 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)**

f)   (i)   State SIX assumptions made in Kinetic theory of gases.   **(3marks)**

   (ii)   The standard free energy change at 25°C was -24.7×10^3J mol^{-1} Calculate value of equilibrium constant Kp.   **(4marks)**

g)   Proof that for gas molecules average KE is proportioned to absolute temperature.

   (3marks)

Question TWO

a)   28% of liquid A (Rmm-140) has vapour pressure of 160mmHg of 37°C. Given vapour pressure of water at 37°C as 150mmHg. Calculate vapour pressure of pure liquid.

   (4marks)

b) The solubility of $CuBr_2$ is 2.0×10^{-4} moles/litre at 25°C. Calculate its solubility product Ksp.   **(3marks)**

c) A given mass occupies 919ml in dry state of S.T.P. The same mass when collected over water at 15°C and 750mmHg pressure occupies are 1L volume. Calculate vapour pressure of water at 15°C.   **(4marks)**

d) Explain briefly deviation of gases at high pressure and low temperature.   **(3marks)**

e) State:-

   (i)   Characteristic of dynamic equilibrium   **(2marks)**

   (ii)   Success of Lewis theory.   **(2marks)**

   (iii)   Limitation of Arrhenius theory   **(2marks)**

Question THREE

a)   Calculate partial pressure of chloride in the following reaction mixture   **(3marks)**

   $PCl_5(g) \rightleftharpoons PCl_3 + Cl_2(g)$ Kp   =   1.05
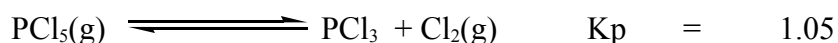
   Given equilibrium partial pressure of PCl_5 and PCl_3 as 0.875 and 0.463 atmospheric respectively.

b) Define the following terms

   (i)   Common ion effect

   (ii)   Organic indicators

(iii)   Immiscible liquid

(3marks)

c) A buffer solution contain 0.2moles of Acetic acid and 0.25moles of potassium acetate per liter of solution. Calculate pH of solution if 0.5ml of 1M HCl is added.   **(4marks)**

d) State:-

(i)   Charles Law   **(2marks)**

(ii)   Delton Law   **(2marks)**

e) 2gms of Neon was mixed with 1gram of Helium in 8 litre vessel exert ctatal pressure of 0.98 atmospheric calculate partial pressure of Neon   **(3marks)**

f) Define :-

(i)   Indicator   **(1.5marks)**
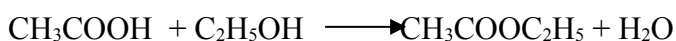
(ii)   Acidic salt   **(1.5mark)**

(iii)   Electrolyte   **(1mark)**

Question FOUR

a) 40grams of acetic acid was mixed with 30grams of ethanol in 2L vessel to form water and ethyl acetate. At equilibrium there were 441grams of water. Calculate equilibrium constant Kx   **(6marks)**

$$CH_3COOH + C_2H_5OH \longrightarrow CH_3COOC_2H_5 + H_2O$$

b) State

(i)   Limitation of Arrhenius theory   **(2marks)**

(ii)   Avogadros Hypothesis   **(2marks)**

(iii)   Law of equilibrium   **(1mark)**

c) Define organic indicators and explain colour change of methyl orange indicator in Basic solution   **(4marks)**

d) A buffer was prepared by mixing 0.1M acetic acid and 0.01M sodium acetate in 1 litre given dissociation constant of Acid as 1.8×10^{-5} calculate:-   **(5marks)**

(i)   pH of this buffer solution

(ii)   pH change when 1ml of 1MNaOH is added to one litre of this buffer.

Question FIVE

a) 48.6 gramms of Ammonia occupies a volume of 5.4L at 45°C. Using Van deer walls equation calculate pressure it will exert given a = 138.9KPa L^2/mol, b = 0.0371L/mol
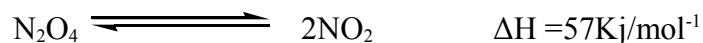
R = 8.314 pam³/K.mol

(P +a(n²/v²) (V-nb) = nRT)   **(4marks)**

b) State :-

   (i)   Three assumptions made in deriving ideal gas equation   **(3marks)**

   (ii)   Using Le Chatelier principle predict direction of equilibrium if volume and Temperature is decrease in the following equilibrium   **(2marks)**

   $$N_2O_4 \rightleftharpoons 2NO_2 \qquad \Delta H = 57Kj/mol^{-1}$$

c) Define

   (i)   Solubility

   (ii)   Solubility product   **(3marks)**

d) Discuss how the following factors affect rate of solubility

   (i)   Temperature   **(2marks)**

   (ii)   Pressure   **(2marks)**

e) Derive ionic product K_w **(2marks)**