TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

DIPLOMA IN PHARMACEUTICAL TECHNOLOGY (DPT 15S)

ACH2207: PHYSICAL CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES:APRIL2016

TIME:2HOURS

DATE: Pick DateSelect MonthPick Year

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

(a) (i) State the condition under which a reversible reaction is said to be at equilibrium (1Mark)

(ii) The Ksp for $PbCO_3$ is 7.4×10^{-14} mol^2 lit^{-2} Find the concentration of Pb^{2+} ions at equilibrium in pure water (3Marks)

(iii) Find the numerical value of pH, pOH and pK_w in

a) Distilled water (3 Marks)

b) 0.001 HCl (3 Marks)

c) 0.001 M NaOH (3 Marks)

b. (i) State Boyle's law and give its equation stating what every symbol in the equation represents (5 Marks)

(ii) Sketch three ways of graphical representation of Boyle's law (6 Marks)

c. (i) Define the term enthalpy of a chemical reaction. State how it differs from enthalpy of a compound. (2 marks)

(ii) Given the equation

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} \quad \Delta H = -394K.J\ mol^{-1}$

Represent this information in form of an energy level diagram (4 Marks)

Question TWO

(a) Define the term homogeneous equilibrium (1 Mark)

(b) When 24.0g of ethanoic acid CH_3COOH and 13.0g of ethanol were allowed to react the equilibrium mixture was found to contain 20g of ethyl acetate $CH_3\ COOC_2H_5$. The reaction equation is

$CH_3COOH + C_2H_5OH \rightleftharpoons CH_3COO_2H_5 + H_2O$

(i) Calculate the equilibrium constant of the reaction given C = 12 O =16 H = 1 (12Marks)

(ii) Suggest two changes that can be made to this system in order to increase the yield of the ester produced. (2 Marks)

Question THREE

$240cm^3$ of 2MHCl solution was added into a beaker containing 37.5g of zinc carbonate ($ZnCO_3$) powder

(a) Determine which reactant was in excess (6 Marks)

(b) Calculate the volume or mass of the insufficient reagent that need to be added to complete the reaction (4 Marks)

(c) Calculate the volume of carbon dioxide produced if the 37.5 of $ZnCO_3$ completely reacted with NCl at 35^oC and 742 mmHg atmospheric pressure given Zn = 65, C -= 12, O = 16, H = 1, Cl = 35.5, Standard pressure = 760mmHg, Standard temperature =273K and Molar Volume of a gas at STP = 22.4Litres (5 Marks)

Question FOUR

(a) Distinguish atomicity from basicity (2 Marks)

(b) Give

(i) Two examples of diatomic gaseous element (2 marks)

(ii) Two examples of triatomic gaseous compound (2 Marks)

(iii) One example of tetratomic gaseous compound (2 Marks)

(iv) Two examples of dibasic acids (2 marks)

(c) (i) Distinguish diffusion from effusion (2 Marks)

(ii) It takes 110 sec for 50 ml of oxygen gas to pass through a small aperture. Find the volume of nitrogen gas N_2 that will pass through the same aperture in 10 min under the same aperture in 10 min under this same condition given N = 14, O = 16 (4 marks)

Question FIVE

(a) Define

(i) Arrhenius acid (1 Marks)

(ii) Bronsted base (1 Marks)

(iii) Conjugate base of an acid (1 Mark)

(b) Given the equation

$$NH_3 + H_2O \rightleftharpoons NH^+_4 + OH^-$$

Identify

A. Bromstead acid (1 Mark)

B. Conjugate base of an acid (1 Mark)

C. Conjugate pair (1 Mark)

(c) (i) State Gay Lussacs Law (3 Marks)

(ii) 72 cm3 of methane CH_4 was exploded with 260 cm3 of oxygen and the mixture allowed to attain the original room temperature. Find the volume of each of the remaining gases (3Marks)

(d) Given the following Ksp data

$Mg(OH)_2$ Ksp = 7.1×10^{-12}

$Mn(OH)_2$ Ksp = 6×10^{-14}

AgBr Ksp = 5.0×10^{-13}

(i) Select the most soluble compound (1 mark)

(ii) Write Ksp expression for $Mg(OH)_2$ (1 mark)