UNIVERSITY OF JAFFNA, SRILANKA
BACHELOR OF PHARMACY
SECOND YEAR SECOND SEMESTER EXAMINATION – AUGUST 2016
PHACH 2224 PHARMACEUTICAL CHEMISTRY III

DATE: 16/08/2016 **TIME: 3 Hours.**

ANSWER TO ALL QUESTIONS.

1.

1.1. Find out the pH of the following solutions at 25^0C.

1.1.1. 0.2M HCl(aq) (5 marks)

1.1.2. 0.25M $Ca(OH)_2$(aq) (5 marks)

1.2. Calculate the $[H_3O^+(aq)]$ and the concentration of $H_2SO_{4(aq)}$ in a solution of a pH of 2.0. (10 marks)

1.3.

1.3.1. Find the pH of a mixture that is 0.25 M in HF and 0.1 M in HClO. (Ka of HF = $3.5X10^{-4}$ and Ka of HClO = $2.8X10^{-8}$) at 25°C (20 marks)

1.3.2. Find out the concentration of ClO^- in this solution. (10 marks)

1.4. A 0.2 M weak acid (HA) solution has a pH of 4.25. Calculate the p*K*a for the acid. (10 marks)

1.5.

1.5.1. Define the terms solubility and solubility product. (10 marks)

1.5.2. 25.0 mL of 0.0040 M potassium chromate are mixed with 175.0 mL of 0.000125 M lead(II) nitrate. Will a precipitate of lead(II) chromate form? (Ksp of lead(II) chromate is 1.8×10^{-14}.) (30marks)

2.

2.1. Derive the Henderson- Hassel Balch Equation by considering a weak acid HA. (10 marks)

2.2. Consider the titration of a 50.0ml sample of 0.2M NH_3 with 0.5M HNO_3 (Kb NH_3=$1.76X10^{-5}$) and determine the following :

2.2.1. Initial pH (10marks)

2.2.2. Volume of titrant required to reach the equivalent point (10 marks)

2.2.3. pH after the addition of 5.0ml of acid (20 marks)

2.2.4. pH at half equivalent point (10 marks)

2.2.5. pH at equivalent point (20marks)

2.2.6. pH after adding 5.0ml of HCl beyond the equivalent point (10marks)

2.2.7. Construct an approximate titration curve for the above titration by using the above calculations. (10marks)

3.

3.1. Write the rate expressions for the following reaction in terms of the disappearance of the reactants and the appearance of the products: $aA+bB \rightarrow cC+dD$ (10 marks)

3.2. State the rate law. (10 marks)

3.3. Consider the following reaction at 1280^0C

$$2NO(g) + 2H_2(g) \xrightarrow{1280\ ^0C} N_2(g) + 2H_2O(g)$$

The above reaction was carried out with different concentrations of reactants in three experiments. The measured initial rates are given below.

Experiment	[NO] (*M*)	[H_2] (*M*)	Initial Rate (*M*/s)
1	$5.0 X10^{-3}$	$2.0X 10^{-3}$	$1.3X10^{-5}$
2	$10.0X10^{-3}$	$2.0X10^{-3}$	$5X10^{-3}$
3	$10.0X10^{-3}$	$4.0X10^{-3}$	$10X10^{-3}$

Calculate the following

3.3.1. Over all reaction order (20 marks)

3.3.2. Rate constant (10 marks)

3.3.3. Rate of the reaction when [NO] $=12.0 X 10^{-3}$ *M* and [H_2] $= 6.0X 10^{-3}$ *M*. (10 marks)

3.4

3.4.1 Derive the reaction half- life equation for first order reaction and second order reaction. (20 marks)

3.4.2 The decomposition of a chemical A is first-order reaction with a rate constant of $5.4 X 10^{-4} s^{-1}$ at 500^0C.

Calculate the half-life of the reaction in minutes. (10 marks)

3.5 Write down the Arrhenius equation and identify its components. (10 marks)

4.

4.1. State the phase rule and define the parts of it. (15 marks)

4.2. Draw the phase diagram of water system and briefly describe it. (40 marks)

4.3. How much of heat is required to change 500 ml of ice at -20^oC into steam? ($C_{ice}=2090J/KgK$, $L_f=3.33X10^5J/Kg$, $C_{water}=4190J/KgK$, $M_L= 22.6X10^5J/Kg$ and density of ice= $920Kg/m^3$) (30 marks)

4.4.

4.4.1. Define "Azeotrope" (10 marks)

4.4.2. Draw the temperature composition diagram for ideal solution, solution with positive deviation and solution with negative deviation. (15 marks)

5.

5.1. Define the following terms

5.1.1. Iso thermal Process (5 marks)

5.1.2. Reversible Process (5 marks)

5.1.3. Adiabetic Process (5 marks)

5.1.4. Irreversible Process (5 marks)

5.2. A cylinder contains 7g of gas. How much of work must be done to compress the gas at a constant temperature 100^0C to bring the volume to half of its initial volume? (MW of the above gas is 28.0g/mol and R=8.3J/molK)

(10 marks)

5.3. State the first law of thermodynamics (10 marks)

5.4. Give the definition for Enthalpy, Entropy and Specific heat. (10 marks)

5.4.1. A 75.0 g aluminium cube at 500^0C is placed in 500 cm^3 of ethyl alcohol contained into a well-insulated container at 20^0C, then quickly removed. The aluminium temperature is found to have dropped to 100^0C. What is the new temperature of ethyl alcohol? (C_{Al} =900J/KgK, $C_{ethyl\ alcohol}$ =2400J/KgK, density of ethyl alcohol = 790Kg/m^3). (15 marks)

5.4.2. An Ice cube at 0^0C is slowly melting. What is the change in the ice cube's entropy for each1.00g of ice that melts? L_f=333.7g/J. (15marks)

5.4.3. Proof that Cp =Cv+R (20 marks)

6.

6.1. Define the Electro motive force. (10 marks)

6.2.

6.2.1. Write the standard line cell notation for the following voltaic cell created by using the following electrodes..

$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$, E°= -0.76 V.

$Cu^{2+} + 2e^- \rightarrow Cu(s)$ $E^\circ = 0.34$ V (10 marks)

6.2.2 Calculate the E^0cell of the above cell. (15 marks)

6.2.3 Calculate the Gibb's free energy change of the above reaction at 25^0C. State whether this reaction occurs spontaneously or not? (15 marks)

6.2.4 Calculate the cell potential (E) at 25^0C for the following cell.

$Cu(s)\ /CuNO_3(0.01\ M)\ //\ CuNO_3(0.1\ M)\ /\ Cu(s)$ (20 marks)

- 6.2.5 The emf of the electrochemical cell given below is 0.650 V. Calculate the maximum electrical work of this cell. (F=96500Cmol^{-1})

$$Hg_2^{2+}(aq) + H_2(g) \longrightarrow 2Hg(l) + 2H^+(aq)$$

(10 marks)

6.3 How much mass would the zinc electrode lose if a current of 0.3 amp flows through the external circuit for 2 hours? (MW of Zn= 65.37 g mol^{-1} F=96500Cmol^{-1})

(20 marks)