

UNIVERSITY OF JAFFNA, SRI LANKA
BACHELOR OF PHARMACY
SECOND YEAR SECOND SEMESTER EXAMINATION – FEBRUARY 2014
PHACH 2201 PHARMACEUTICAL CHEMISTRY III

Date: 01.04.2014

Time – 3 hours

Answer All Six Questions. Answer **part A** and **part B** in separate answer books

Part A

- 1 1.1 Prove that the Joule – Thompson expansion is an isenthalpic process and define the Joule – Thompson co-efficient. (20 Marks)
- 1.2 Assuming $H = f(P,T)$ show that
$$\mu_{JT} = - 1/C_p(\delta H/\delta P)_T$$
 (40 Marks)
- 1.3 Drive an expression for relationship between isochoric heat capacity and Isobaric heat capacity. (40 Marks)

- 2 2.1 Define the flowing symmetry elements and explain the corresponding operation with an example
 - (i) Identity (08 Marks)
 - (ii) Inversion centre or centre of symmetry (08 Marks)
 - (iii) Rotation axis (08 Marks)
 - (iv) Mirror plane or planer symmetry (08 Marks)
 - (v) Rotation reflection axis (08 Marks)
- 2.2 Give the shape and list all the symmetry elements present in the following molecules.
 - (i) NH₃ (04 Marks)
 - (ii) SF₆ (04 Marks)
 - (iii) CH₄ (04 Marks)
 - (iv) SiF₄ (04 Marks)
 - (v) H₂O (04 Marks)
- 2.3 2.3.1 State the Bragg's equation and define all terms involved in it. (20 Marks)
- 2.3.2 A first order reflection from the {111} plane of a cubic crystal was observed at a glancing angle of 11.2° when Cu(K_α) X-rays of wave length 154pm were used. What is the length of the side of the unit cell? (20 Marks)

- 3 3.1 Define the term entropy change and write the criteria for spontaneity, equilibrium and non spontaneity for a process in terms of entropy (20 Marks)
- 3.2 How would you calculate the change in entropy when the pressure of a perfect gas is changed isothermally from P_i to P_f. (40 Marks)
- 3.3 Define the term enthalpy. How would you calculate enthalpy change when an ideal gas expands adiabatically? (40 Marks)

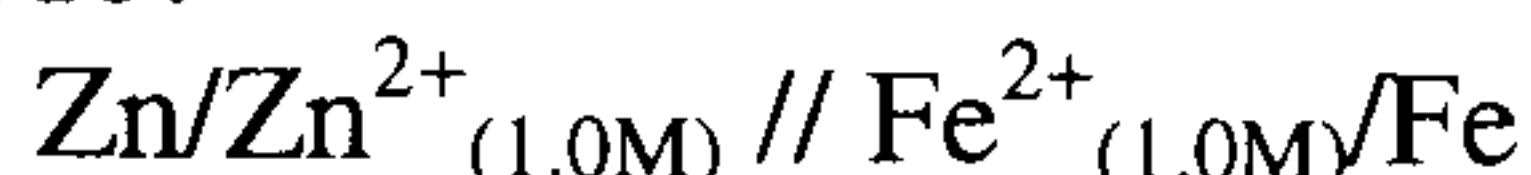
- 4 4.1 Define the terms
 - (i) Electrolyte (04 Marks)
 - (ii) Electrodes (04 Marks)
 - (iii) Electromotive force (04 Marks)
 - (iv) Electrode potential (04 Marks)
 - (v) Conductivity (04 Marks)

- 4.2 Calculate the potential E, for the $\text{Fe}^{3+}/\text{Fe}^{2+}$ electrode when the concentration of Fe^{2+} is exactly five times that of Fe^{3+} . $E^\circ = +0.771\text{V}$ (10 Marks)
- 4.3 4.3.1 State Faradays's first law of electrolysis (10 Marks)
- 4.3.2 Calculate the Gibb's free e nergy change in J/mol at 25°C for following reactions.



(10 Marks)

- 4.3.3 what is the E° for the following electrochemical cell when Zn is the cathode?



$$E^\circ_{(\text{Zn})} = -0.76$$

$$E^\circ_{(\text{Fe})} = -0.44$$

(10 Marks)

- 4.4 State Debye-Huckle equation and define all terms involved in it
A particular solution contain 0.01, 0.02 and 0.01 $\text{mol}/\text{dm}^{-3}$ in concentration with respect to KCl, FeCl_3 and $\text{K}_3\text{Fe}(\text{CN})_6$ respectively. Calculate the ionic strength of the solution and mean activity of the electrolyte FeCl_3 in this solution. (value for $A=0.509$, value for $B_a = 1.25$) (40 Marks)

Part B

- 5 5.1 Define the terms "reaction rate" and "reaction order". (30 Marks)

- 5.2 Bromide ion is oxidized by bromate ion in acidic solution.



$$\text{Rate} = k[\text{Br}^-] [\text{BrO}_3^-] [\text{H}^+]$$

What is the order of reaction with respect to each reactant species? What is the overall order of the reaction?

(30 Marks)

- 5.3 What are the integrated rate law for first order and zero reactions? (20 Marks)

- 5.4 Derive the half-life from first principle for 1st order reactions. (20 Marks)

- 6 6.1 Briefly describe the acid base theories with example. (40 Marks)

- 6.2 Derive the Henderson equation for an acidic buffer. (30 Marks)

- 6.3 A buffer solution contains 0.25M NH_3 and 0.40M NH_4Cl . Calculate the pH of the solution. K_b for ammonia = 1.8×10^{-5} . (15 Marks)

- 6.4 A chemist needs a buffered solution of propanoc acid, $\text{CH}_3\text{CH}_2\text{COOH}$, and its salt $\text{CH}_3\text{CH}_2\text{COONa}$. Calculate the ratio $\text{CH}_3\text{CH}_2\text{COOH}/$

$\text{CH}_3\text{CH}_2\text{COONa}$ required to yield a pH of 4.3. K_a of propanoic acid is 1.3×10^{-5} .

(15 Marks)