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DEPARTMENT OF SCIENCES, MANIPAL UNIVERSITY, MANIPAL

## I SEMESTER M.Sc END SEMESTER EXAMINATIONS, Dec 2015/Jan2016 SUBJECT: PHYSICAL CHEMISTRY I [CHM 605]

(Make up examination)

## REVISED CREDIT SYSTEM

Time: 3 Hours

Date: 5-1-2016

MAX. MARKS: 50

## Instructions to Candidates:

- Answer ANY FIVE FULL questions.
- Draw diagrams and write equations wherever necessary.
- a) Justify the statement: Free energy of the system decreases during adsorption process.
  b) Define ionic strength of a solution. Calculate ionic strength of a solution obtained by mixing 50mL of 0.1M KCl, 50mL of 0.01M CaCl<sub>2</sub>.

c) Explain in detail, mechanism of explosion for the gas phase combustion of hydrogen and with a suitable graphical representation. Arrive at conditions for explosion limits.

[2+2+6]

**2. a)** Justify the statement: In case of uni-univalent electrolyte mean activity coefficient depends only on ionic strength and not on the nature of the electrolyte.

**b**) A first order reaction is 60% complete in 80 minutes. Calculate rate constant and the half life of the reaction.

**c**) Write Lippmanne equation and give its graphical representation. Explain the determination of interfacial tension of mercury –HCl system using Lippmanne electrometer.

[2+2+6]

**3.** a) Justify the statement: Michelson Menton constant for enzyme catalysis can be evaluated by two graphical methods.

**b**) Calculate the free energy change accompanying the compression of 1 mole of a gas at 330 K from 25 to 200 atm. The fugacities of the gas at 330 K may be taken as 23 and 91 atm respectively, at pressures of 25 and 200 atm.

c) What is meant by general and specific acid catalysis? Derive one expression each for rate constants for specific and general acid catalysis.

[2+2+6]

**4.** a) Construct a phase diagram for three component system and locate the point 'P' corresponding to following composition: A = 30%, B = 20% and C = 50%.

**b**) Define a consecutive reaction. With the help of a graph, show the variation concentration of various species in a consecutive reaction.

c) State the third law of thermodynamics. Explain how the absolute entropy of a substance can be determined with the help of the third law of thermodynamics.

[2+2+6]

**5. a)** Justify the following statement: Gibbs phase rule needs modifications when applied to two and three component systems.

**b**) Discuss the application of the condensed phase rule to the study of acetic acid-chloroform-water system.

c) Compare and contrast assumptions of Langmuir and B.E.T adsorption isotherms. Explain the use of B.E.T adsorption isotherm in the calculation of surface area of the catalyst.

[2+2+6]

**6. a**) Justify: Integrated form of the Clausius- Clapeyron equation can be obtained for solid vapor equilibria but not for solid liquid equilibria.

**b**) At 300 K, a first order reaction is 50% complete in 20 min. At 350 K, the same reaction is 50% complete in 10 min. Calculate the energy of activation.

c) Explain the Stern model for electrical interface and prove that it has a total differential capacity of Helmholtz and Gouy capacities in series. Comment on the model adopted in various concentrations of electrolyte.

[2+2+6]

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