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# Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

**IV SEMESTER B.TECH. (CHEMICAL ENGG.) MAKEUP EXAMINATION JUNE-JULY, 2016**

SUBJECT: PHYSICAL CHEMISTRY (CHM 2201)

**REVISED CREDIT SYSTEM**

Time: 3 Hours Date: 07/07/2016 MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

**1A.** Show that the relative lowering of vapour pressure of a solution is equal to the mole fraction of the solute present in the solution. Calculate the molar mass of the substance if 1.20 g of a non-volatile organic substance was dissolved in 100 g of acetone at 20° C. The vapour pressure of the solution was found to be 182.5 mm of mercury. Given: vapour pressure of acetone at 20° C is 185 mm.

**1B.** State Henry's law. Mention any two of its applications. Show that in any solution, if the solute obeys Henry's law, the solvent obeys Raoult's law.

**1C.** Differentiate between molecularity and order of a reaction. Explain how transition state theory is useful in the determination of the rate constant of a reaction?

**[2+4+4]**

**2A.** Give reasons for the following;
**i)** Condensed phase rule is applied to two component systems.
**ii)** Platinized Pt electrodes are used in conductivity cell.

**2B**. **i)** Define the term activation energy. Derive an expression for rate constant determination using Arrhenius equation.
**ii)** A 0.01 N $CuSO_4$ solution shows a resistance 225 ohms in a conductivity cell. The specific conductacne of 0.01 N $CuSO_4$ solution at the temperature of experiment is 0.0141 mho/cm. If a 0.02 N solution of an acid shows a resistance of 80 ohms in the same cell, find the specific and equivalent conductacne of the acid.

**2C.** **i)** Explain the experimental procedure for obtaining a cyclic voltamogram of $K_3Fe(CN)_6$.
**ii)** Differentiate between solutions that show positive and negative deviations from Raoult's law.

**[2+4+4]**

**3A.** State the laws of osmotic pressure. A solution containing 4.3 g per dm3 of urea (molar mass = 60) was found to be isotonic with a 3 % solution of an organic non- volatile solute. Calculate the molar mass of the latter.

**3B.** State phase rule. What is the difference between critical point and triple point?
Draw the labelled phase diagram for Zn-Mg system and explain it.

**3C.** Discuss the principle and procedure involved in the precipitation titration by potentiometric method. Mention why potentiometric method is preferred to conductometric during a precipitation titration.

**[2+4+4]**

**4A.** What is the objective of steam distillation?
A mixture of bromobenzene and water distills at 95.2 °C, at which the respective vapour pressures a110 and 650 mm. The ration by weight in which the liquids distil is bromobenzene**:** water = 1.52**:** 1. Calculate the molecular weight of bromobenzene.

**4B.** Write the B.E.T. equation and explain the terms. Explain the verification of B.E.T equation and how the surface area of an adsorbent can be determined using it.

**4C**. Derive the relationship between the freezing point depression of a solution and the mole fraction of the dissolved solute. Calculate the molal freezing point constant of benzene if 0.36 g of a substance of molar mass 173 when dissolved in 25.5 g of benzene lowered the freezing point by 0.42 °C.

**[2+4+4]**

**5A.** Justify the following statements:
**i)** A given solute would be more readily adsorbed from aqueous solution than from alcoholic solutions.
**ii)** Adsorption is accompanied by decrease in enthalpy as well as decrease in entropy of the system.

**5B.** Give reason: Nitric acid –water mixture always exhibit negative deviation from Raoult's law. Explain the distillation behavior of solutions of type III with a suitable example.

**5C.** **i)** The Henry's law constant for $CO_2$ in water at 298 K is 1.64 x $10^3$ atm. Calculate the solubility of $CO_2$ at 298 K and 1 atm.
**ii)** A second order reaction in which the initial concentrations of both the reactions are same is 25 % complete in 500 sec. How long will it take for the reaction to go to 75% completion?

**[2+4+4]**

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