This question paper contains 4 printed pages.]

Your Roll No. .....

5105

B.Sc. Prog. /II B

CH-203 : PHYSICAL CHEMISTRY

(Admissions of 2008 and Onwards)

Time : **2** *Hours* *Maximum Marks* : 50

(Write your Roll No. on the top immediately on receipt of this question paper.)

Use of scientific calculators is allowed.

Attempt ***Four*** questions in all.

Question No. 1 is compulsory.

1. Explain

   (a) Effect of impurity on critical solution temp of Phenol-H_2O system.

   (b) Solutions of electrolytes do not obey Raoult's law.

   (c) Lowering of vapour pressure of a solution on addition of a non-volatile solute to it at a given temperature.

(d) Effect of temperature on surface tension of a liquid.

(e) Limitations of Nernst Distribution Law.

(f) Ethanol has a higher viscosity than ether.

(g) Advantages of conductometric titrations over volumetric titrations. **2 × 7 = 14**

2. (a) Define specific, molar and equivalent conductances. Give the SI units along with the relationship between them.

(b) How will you determine the solubility of a sparingly soluble salt conductometrically ?

(c) The equilibrium constant, K_p for the reaction

$$N_2 + 3\,H_2 \rightleftharpoons 2\,NH_3$$

is 1.64×10^{-4} at 400 °C. What will be the equilibrium constant at 500 °C if the heat of reaction in this temp range is –25140 calories ? (R = 1.987 cal / deg mol) **4, 4, 4**

3. (a) Discuss the principle of steam distillation with suitable examples.

(b) At a pressure of 760 mm, a mixture of nitrobenzene ($C_6H_5NO_2$) & H_2O boils at 99 °C. The vapour pressure of water at this temp is 733 mm. Find the proportion of water in nitrobenzene in the distillate obtained from the boiling mixture.

(c) Apply Le-Chatelier's principle to predict the effect of T & P on the following reactions.

(i) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$ $\Delta H = 180.5$ kJ

(ii) $4HCl(g) + O_2(g) \rightleftharpoons 2H_2O(g) + 2Cl_2(g)$ $\Delta H = -113.0$ kJ **4, 4, 4**

4. (a) Draw the Andrews isotherm for CO_2 gas and hence derive, P_c, V_c and T_c in terms of Van der waal's constants 'a', 'b' and gas constant 'R'.

(b) Calculate the temperature at which N_2 molecules have the same root mean square velocity as hydrogen molecules.

(c) Define surface tension & give its SI units. Describe the lab method to determine the surface tension of an unknown liquid. **5, 3, 4**

5. (a) Define :

(i) Triple Point

(ii) Eutectic Point

(iii) Congruent melting point &

(iv) Invariant system with examples

(b) Sketch the phase diagram of a one component system and discuss its salient features.

(c) Derive the following relations :

(i) $\left(\frac{\partial \mu_i}{\partial T}\right)_{P,nj} = -\bar{S}_i$ &

(ii) $\left(\frac{\partial \mu_i}{\partial P}\right)_{T,nj} = \bar{V}_i$ **4, 4, 4**

6. Write short notes on any **three.**

(a) Liquid Junction Potential

(b) Quinhydrone Electrode

(c) Moving Boundary method

(d) Phase Diagram of lead-silver system

(e) pH titrations

(f) Elevation of boiling point of a solution on addition of a non-volatile solute. **4, 4, 4**
