

**Subject Code—60421**

**B. Sc. EXAMINATION**

(Batch 2019 Onwards) (Main/Re-appear)

(Third Semester)

**CHEMISTRY**

**CCL-304 (Course V)**

**Physical Chemistry-II**

(Solutions, Phase, Equilibrium, Conductance and  
Electrochemistry)

*Time : 3 Hours*

*Maximum Marks : 80*

**Note :** Attempt *Five* questions in all, selecting *one* question from each section. Q. No. 1 is compulsory.

1. (a) What are the limitations of Raoult's Law ?
- (b) What is Konowaloff's rule ?

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- (c) What is meant by triple point of water ?  
Why is it different from normal m.pt. of ice ?
- (d) Calculate degree of freedom for an aqueous solution of glucose.
- (e) Define specific conductivity. What are its units ?
- (f) How is electrical conduction of metals and electrolyte solution affected on increasing temp. ?
- (g) Why can a voltmeter not be used to measure the EMF of the cell ?
- (h) Define liquid junction potential ? How can it be minimized ? **2 each**

### Section I

- 2. (a) Differentiate between ideal and non-ideal solutions. **4**
- (b) Explain the effect of impurities on critical solution temperature. **6**
- (c) State and explain Raoult's law for solution containing non-volatile solute ? **6**

3. (a) Define azeotropes. Briefly explain different types of azeotropes. 6
- (b) Calculate entropy of mixing when 15g of benzene is mixed with 15 g of cyclohexane. 6
- (c) What is the cause of negative deviations from Raoult's Law ? What are its consequences ? 4

### Section II

4. (a) Draw a well labelled diagram for water system. 6
- (b) Explain the terms with suitable examples (any two) : 2+2+2
- (i) Triple point
- (ii) Cryohydric point
- (iii) Invariant system.
- (c) Water boils at 373 K at one atm. pressure. At what temp. will it boil when atm. pressure becomes 528 mm of Hg at some space station. Latent heat of water =  $2.28 \text{ kJg}^{-1}$  and  $R = 8.314 \text{ JK}^{-1} \text{ mol}^{-1}$ . 4

5. (a) Derive Clausius-Clapeyron equation. 8
- (b) Why  $\text{KCl} = \text{NaCl} = \text{H}_2\text{O}$  is a three component system while  $\text{NaBr} = \text{KCl} = \text{H}_2\text{O}$  is a four component system ? 6
- (c) Explain incongruent melting point. 2

### Section III

6. (a) Discuss any four factors that influence transport number of ions. 8
- (b) Calculate the molar ratio of acetic acid and sodium acetate to prepare a buffer solution of molarity 0.2 and  $\text{pH} = 4.4$ . The dissociation constant of acetic acid is  $1.8 \times 10^{-5}$ . 4
- (c) How can Kohlrausch's law be applied to determine the solubility product of sparingly soluble salts ? 4
7. (a) Define buffer solution. Explain different types of buffer solution with examples. 4

- (b) 0.5N Solution of a salt placed between two platinum electrodes 2.0 cm apart and of area of cross section 4.0 sq. cm. has a resistance of 25 ohms. Calculate the equivalent conductivity of the solution. 6
- (c) Derive the expression for the hydrolysis constant of a salt of weak acid and a strong base. 6

#### Section IV

8. (a) Why an electrochemical cell stops working after some time ? 4
- (b) Calculate the equilibrium constant at 25°C for the reaction
- $$\text{Zn (s)} + \text{Cu}^{2+} (1\text{M}) \rightleftharpoons \text{Cu (s)} + \text{Zn}^{2+} (1\text{M})$$
- $E^\circ$  of the cell is 1.10V. 4
- (c) Derive the expression for the EMF of the cell with transference. 8

9. (a) What is amalgam electrode ? Why are amalgam electrodes preferred over metal-metal ion electrodes ? 4
- (b) Discuss the principle of potentiometric titrations. Briefly explain acid base titrations using potentiometric method. 2+4
- (c) Define concentration cells. Briefly explain types of concentration cells. 6

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