

U.G. 4th Semester Examination - 2024

CHEMISTRY**[HONOURS]**

Course Code : CHEM-H-CC-T-8

(Physical Chemistry)

Full Marks : 40

Time : $2\frac{1}{2}$ Hours*The figures in the right-hand margin indicate marks.**Candidates are required to give their answers in their own words as far as practicable.*1. Answer any five questions: 2×5=10

- a) What is azeotrope?
- b) Discuss the effect of dilution on the specific conductance and equivalent conductance of a strong electrolyte.
- c) Find the number of degrees of freedom for the given equilibria: Pure partly frozen acetic acid.
- d) Explain Konowaloff rule.
- e) Calculate ΔG at 25°C and 1 atm for reaction:
 $\frac{1}{2} \text{H}_2(\text{g}) + \text{AgCl} = \text{Ag} + \text{H}^+ + \text{Cl}^-$. Given that E of the cell $\text{Pt}, \text{H}_2(\text{g}) \mid \text{HCl}, \text{AgCl} \mid \text{Ag}$ is 0.35252V at 25°C .

[Turn Over]

- f) Prove that $[\partial/\partial x, x]=1$
- g) Write down the Hamiltonian operator for electrons in He- atom.
- h) Calculate the ionic strength of a solution containing 0.01 m BaCl_2 .

2. Answer any two questions: $5 \times 2 = 10$

- a) Explain the phase diagram of a two component liquid-liquid system-Phenol water system. State the Kohlrausch's law of independent migration of ions. $3+2=5$
- b) What is liquid junction potential and how it can be eliminated? Find the number of degrees of freedom at the triple point of water. $3+2=5$
- c) i) How much urea must be dissolved in 10^{-2}m^3 of water to yield a solution whose osmotic pressure is $2.03 \times 10^5 \text{ N.m}^{-2}$ at 300 K?
- ii) When will the van't factor i be fractional? $3+2=5$
- d) What do you understand by bonding, antibonding and nonbonding molecular orbitals? Write down the basics of Hartree-Fock SCF method. $3+2=5$

3. Answer any two questions: $10 \times 2 = 20$

- a) i) Give the phase diagram for Sulphur system and discuss the importance of various points, lines and areas.
- ii) A solution containing 0.684 gm of cane sugar in 100 gm of water freezes at -0.037°C , while a solution containing 0.585 gm of NaCl in 100 gm of water freezes at -0.342°C . Calculate K_f for water, i and % dissociation of NaCl . $6+4$
- b) i) Write a short note on quinhydrone electrode.
- ii) Write down the expression for Debye-Huckel limiting law for strong electrolytes. Comment on the validity and limitations of the law. $5+5$
- c) i) Briefly discuss the main features of LCAO-MO treatment of H_2^+ species.
- ii) Distinguish between VBT and MOT. $5+5$