

**BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING
EXAMINATION (SUPPLEMENTARY), 2024**

(SECOND YEAR FIRST SEMESTER)

Subject: Physical Chemistry

Full Marks – 100

Time: 3 hours

Use Separate Answer Scripts for each Part

Part –I

Answer any ten questions:

3×10 = 30

1. Define equivalent conductance. What is its unit?
2. What is 'mean ionic activity co-efficient'?
3. NaCl is soluble in H₂O but insoluble in CCl₄ – why?
4. What is irreversible cell? Give an example.
5. What is meant by decomposition potential?
6. What is concentration polarization?
7. On what factors, does the solubility of a sparingly soluble salt depend?
8. Mention two industrial applications of conductometric titrations.
9. What is potentiometric titration?
10. On what factors, does the overpotential of an electrochemical cell depend?
11. Define surface energy.
12. What is contact angle?
13. What is CMC of surfactants?
14. What are lyophobic colloids?
15. What is Gibb's adsorption isotherm?

Part –II

Answer any seven questions:

10×7 = 70

1. Explain the variation of equivalent conductance of strong and weak electrolytes with concentration. **5+5 = 10**
2. Give a brief account of the relaxation effect and electrophoretic effects in relation to Debye-Hückel theory of ionic atmosphere. **5+5=10**
3. (a) The statement 'With decrease of concentration, the degree of dissociation of weak electrolyte increases' – Justify or criticize. **6**
(b) The pH of a 10⁻³ (M) aqueous solution of weak acid was found to be 4.0 at 25 °C. Find the degree of dissociation. **4**
4. Define the term 'solubility product'. Derive an expression for the activity solubility product of a sparingly soluble salt, A_pB_q at a particular temperature. **3+7 = 10**

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5. What is conductometric titration? Explain the conductometric titration curve of CH_3COOH solution vs. NaOH solution. **3+7 = 10**
6. Define electromotive force. From the thermodynamic consideration, deduce the relationship between equilibrium constant and electromotive force of an electrochemical cell. **3+7 = 10**
7. What is fuel cell? Discuss the advantage and disadvantages of fuel cell. **3+4+3=10**
8. Define surface tension. Which type of fluids will have zero surface tension and why? Do wetting agents reduce surface tension? What does the wettability of a surface depend on? **2+3+2+3=10**
9. Define surfactant. What are the three different types of surfactant and write their applications. Why do the surfactant molecules decrease the surface tension of water? **2+5+3=10**
10. What happens during endosmosis? What is the streaming potential of a colloid? Can colloidal solution be purified by electrophoresis? How can alum help in water purification? **3+3+2+2=10**
11. Distinguish among the (a) surface, (b) Stern, and (c) zeta potential boundaries? Draw a picture of a colloidal solution and label these boundaries. **2+2+2+4=10**
12. What is the mechanism of formation of microemulsions? What are the unique properties of microemulsions? How microemulsion can acts as a template for the fabrication of size-controlled nanoparticles? **3+3+4=10**