

BACHELOR OF ENGINEERING IN CHEMICAL ENGINEERING EXAMINATION, 2024

(2nd Year, 1st Semester)

Subject: Physical Chemistry

Time: 3 hours

Full Marks – 100

Use Separate Answer Scripts for Each Part

Part – I

Answer Any Ten:

3×10 = 30

1. What are the factors that affect electrolytic conduction?
2. Give the definition of specific conductance. How does it depend on the cell constant?
3. What is meant by 'standard reduction potential'? Write down the Nernst equation and explain the terms involved.
4. What is meant by cell potential? How is cell potential affected by concentration of the reactants?
5. NaCl is soluble in H₂O but insoluble in CCl₄ – why?
6. What is concentration polarization? Explain with an example.
7. Draw the relation between solubility and solubility product for the sparingly soluble salts: (i) AgCl and (ii) CaF₂.
8. State the differences between reversible and irreversible cells.
9. Mention two industrial applications of conductometric titrations.
10. Write the unit and dimension of surface tension.
11. What are the factors affecting wettability of a surface by a liquid?
12. What are anionic surfactants? Give one example.
13. Fog is an example of which type of colloidal system?
14. How does water strider can walk on water surface?
15. What are the key criteria for defining nanoparticles?

Part – II

Answer Any Seven:

10×7 = 70

1. Give a brief account of the relaxation effect and electrophoretic effect in relation to Debye-Hückel theory of ionic atmosphere. **5+5=10**

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2. What is meant by 'electromotive force'? Derive an expression for the electromotive force of a Daniel cell. What is the necessity of amalgamation of metal-metal ion electrodes? **3+5+2=10**

3. What is conductometric titration? What is the advantage of conductometric titration against indicator titration for acid-base neutralization? Explain the conductometric titration curve of CH_3COOH vs. NH_4OH . **2+2+6=10**

4. (a) From thermodynamic consideration show that the entropy change of a reversible electrochemical cell can be obtained by measuring the temperature co-efficient of the cell. **7**
 (b) A 0.02 (M) KCl solution having a specific conductance of $27.7 \times 10^{-4} \text{ ohm}^{-1} \text{ cm}^{-1}$ gives a resistance of 175 ohms when measured in a certain conductivity cell. A 0.01 (M) solution of sodium acetate in the same conductivity cell shows a resistance of 575 ohms. Calculate the equivalent conductance of sodium acetate solution. **3**

5. What is meant by potentiometric titration? Discuss the method of estimation of chlorides by potentiometric titration with AgNO_3 solution. **2+8=10**

6. What are secondary cells? How secondary cell can act as storage cells? What are the conditions to be maintained to perform as ideal storage cells? **2+5+3=10**

7. What is meant by overpotential? On what factors, does the overpotential of an electrochemical cell depend? How can the overpotential be measured experimentally? **2+3+5=10**

8. Which are the forces responsible behind the origin of surface tension? Derive the equation which relates the change in surface energy, the surface tension and area of a fluid. **3+7=10**

9. Define critical micellar concentration (CMC). Differentiate between micelle and reverse micelle. Explain the entropy change in the process of micellization from surfactant monomer with diagram. **2+3+5=10**

10. Why do surfactant molecules decrease the surface tension of water? What are water-in-oil and oil-in-water microemulsions? Describe the preparation of metal nanoparticles in water-in-oil microemulsions. **3+3+4=10**

11. Discutypes of colloids and examples? What is the sedimentation potential of electrokinetic phenomenon? What is the purpose of electro-osmosis? **3+4+3=10**

12. What is the electric double layer of a colloidal solution? Define zeta potential with diagram. Write the equation of Gibb's adsorption isotherm of surface excess and define the term involved therein. **3+4+3=10**