

**2024/TDC (CBCS)/EVEN/SEM/
CHMHCC-403T/304**

TDC (CBCS) Even Semester Exam., 2024

CHEMISTRY

(4th Semester)

Course No. : CHMHCC-403T

(Physical Chemistry—IV)

Full Marks : 50

Pass Marks : 20

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

UNIT—1

- 1. Answer any two questions : 2×2=4**
- (a) State and explain Kohlrausch law of independent migration of ions with a suitable example.
- (b) Deduce the relation between equivalent conductivity and normality.
- (c) What is Debye-Falkenhagen effect?

2. Answer any one question :

6

(a) Give an account of Debye-Hückel theory of strong electrolyte. Explain clearly asymmetric effect and electrophoretic effect.

3+3=6

(b) (i) The conductivity of a solution containing 1 g BaCl_2 in 200 cm^3 of water is 0.0058 S cm^{-1} . What are the molar conductivity and equivalent conductivity of the solution? (At. wt. of Ba = 137)

3

(ii) Write a short note on Wien effect.

3

UNIT—2

3. Answer any two questions :

2×2=4

(a) What is the solubility product constant expression for—

(i) potassium chromate;

(ii) aluminium sulphide?

(b) Discuss the factors affecting transport number.

(c) Explain the determination of ionic product of water using conductance measurement.

4. Answer any *one* question :

6

(a) (i) The conductivity of a saturated solution of AgCl is $1.382 \times 10^{-6} \text{ Scm}^{-1}$. Find its solubility, if ionic conductance of Ag^+ and Cl^- at infinite dilution are $61.9 \text{ Scm}^2 \text{ mol}^{-1}$ and $76.3 \text{ Scm}^2 \text{ mol}^{-1}$ respectively.

2

(ii) Explain how transference number can be determined by Hittrof's method.

3

(iii) Define transference number with respect to cation and anion.

1

(b) (i) What is the principle of conductometric titration? Mention two advantages of conductometric titration.

2+1=3

(ii) Explain how conductance measurement is useful in determining the degree of dissociation of a weak electrolyte.

3

UNIT—3

5. Answer any *two* questions :

2×2=4

(a) One faraday of electricity deposits one mol of Na from the molten salt but $\frac{1}{3}$ mol of Al from an aluminium salt. Why?

- (b) Explain the role of salt bridge in a galvanic cell.
- (c) Write the electrode reaction, net reaction and cell notation for an electrode reversible with respect to anion.

6. Answer any one question : 6

(a) (i) An aqueous solution of CuSO_4 is electrolyzed using platinum-electrodes in one case and copper-electrodes in another case. Will the products of electrolysis be same or different? Give reason. 3

(ii) A current of 4 ampere was passed for 1.5 hours through a solution of CuSO_4 , when 3.2 g of copper was deposited. Calculate the current efficiency. 3

(b) (i) Explain the electrolytic extraction of aluminium from alumina by Hall-Heroult process with a suitable diagram. 3

(ii) Derive Nernst equation and mention its application. 2+1=3

UNIT—4

7. Answer any *two* questions : 2×2=4
- (a) Write a brief note on concentration cell.
 - (b) Explain the principle of potentiometric titration with reference to redox reaction.
 - (c) Write the relation and explain the terms for entropy change with e.m.f.
8. Answer any *one* question : 6
- (a) (i) Derive the relation between entropy change and e.m.f. of a cell. 3
 - (ii) Derive an expression using e.m.f. to determine the pH of an unknown solution by using a hydrogen electrode. 3
 - (b) Derive the expression for the e.m.f. of concentration cells (i) with transference and (ii) without transference. 3+3=6

UNIT—5

9. Answer any *two* questions : 2×2=4
- (a) How does polarization depend on temperature? Explain.
 - (b) Define ferromagnetism with example.
 - (c) Explain dielectric electrostatics.

10. Answer any *one* question : 6
- (a) (i) Derive Lorentz-Lorenz equation. 2
- (ii) Write short notes on diamagnetism and paramagnetism. 2+2=4
- (b) (i) Deduce Clausius-Mossotti equation. 3
- (ii) What is dipole moment? How can dipole moment be measured using temperature method? 1+2=3
