

**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)

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.

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(Continued)

(3)

4. Answer any one question : 6

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

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(Turn Over)

(4)

(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

(5)

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.

(6)

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

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