

PHYSICAL: ELECTROCHEMISTRY**THEORY****Unit I: Electrolytic Conductance**

Electrolytic and metallic conductance. Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Molar conductivity at infinite dilution. Kohlrausch law of independent migration of ions. Debye-Hückel-Onsager equation, Wien effect, Debye-Falkenhagen effect.

Ionic velocities, mobilities and their determinations. Grotthus conductance, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Anomalous transference numbers. Waldens rule.

Application of EMF measurements in determining (i) Gibbs energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinhydrone and glass electrodes.

Unit II: Chemical Cells

Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation; Standard electrode (reduction) potential and its application to different types of half-cells. Determination of exact value of half-cell potential, dissociation constant of weak acid, ionic product of water by graphical method.

Application of EMF measurements in determining (i) Gibbs energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone and glass electrodes.

Concentration cells with and without transference, liquid junction potential; Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation).

Recommended texts:

1. Atkins, P.W & Paula, J.D. *Physical Chemistry*, 9th Ed., Oxford University Press 2011.
2. Castellan, G. W. *Physical Chemistry* 4th Ed., Narosa 2004.
3. Mortimer, R. G. *Physical Chemistry* 3rd Ed., Elsevier: NOIDA, UP 2009.
4. Barrow, G. M., *Physical Chemistry* 5th Ed., Tata McGraw Hill: New Delhi 2006.
5. Engel, T. & Reid, P. *Physical Chemistry* 3rd Ed., Prentice-Hall 2012.
6. Rogers, D. W. *Concise Physical Chemistry* Wiley 2010
7. Silbey, R. J.; Alberty, R. A. & Bawendi, M. G. *Physical Chemistry* 4th Ed., John Wiley & Sons, Inc. 2005.

PRACTICAL

PHYSICAL: CONDUCTOMETRY AND POTENTIOMETRY

Conductometry

1. Determination of cell constant
2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
3. To perform the following conductometric titrations:
 - i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base
 - iii. Mixture of strong acid and weak acid vs. strong base
 - iv. Strong acid vs. weak base

Potentiometry

- II To perform the following potentiometric titrations:
- i. Strong acid vs. strong base
 - ii. Weak acid vs. strong base
 - iii. Dibasic acid vs. strong base
 - iv. Potassium dichromate vs. Mohr's salt

Recommended Texts:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi 2011.
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York 2003.
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.*; W.H. Freeman & Co.: New York 2003.