



ELEMENTARY ELECTROCHEMISTRY

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PRE-REQUISITES : Knowledge of thermodynamics

INTENDED AUDIENCE : B.Sc Chemistry Students

INDUSTRY SUPPORT : Chemical industry

COURSE OUTLINE :

This course would highlight the basic concepts of electrochemistry in the elementary level and will be combined with some basic experiments to understand the theories. Construction of electrochemical cells, fuel cells and their applications, laws of electrolysis, theory of conduction of electricity in solution, ionic equilibrium etc will be discussed in detail. Practical applications like cyclic voltammetry and polarography will be introduced.

ABOUT INSTRUCTOR :

The instructor has obtained his Ph. D. in 2005 from Indian Institute of Science, Bangalore working in the area of small molecule X-ray crystallography. Following that he has worked in the University of Liverpool as a post-doctoral fellow from October, 2004 to September, 2007. Then he moved to BITS, Pilani as Assistant Professor in Chemistry. From there, he moved to IISER Mohali in December, 2009 as Assistant Professor in chemistry. He has more than 70 publications in various international journals, guided two PhD students and a few masters students at IISER Mohali. He offers the same course at IISER Mohali in the August Semester.

COURSE PLAN :

Week 1: (i) Introduction to the course and evaluation components : Introduction to Electrochemistry

(ii) Electrochemistry: The laws of electrochemistry and electrolysis : Faraday's laws of Electrolysis, Arrhenius theory of electrolytic dissociation, concept of units in electrochemistry.

(iii) Electrochemistry: Electrochemical cells : Electrochemical potential, the Nernst equation, electrochemical cell, standard electrode potential and cell potential, reaction Gibbs energy and cell potential.

Week 2: (i) Electrochemical Cells : Cell EMF and equilibrium constant, activity coefficient, construction of an electrochemical cell and calculation of cell EMF and electrochemical series Various electrodes (Glass, SHE, Calomel etc) and their applications, Liquid junction potential, concentration cell, polarization and overpotential

(ii) Applications of EMF measurement : Demonstration Experiments of EMF measurement

Week 3: Fuel cell : Construction and Application

Week 4: Electrolytic solutions : Migration of ions, the transport number, Hittorf's rule and determination of transport number. Conductance in solution, specific conductance, equivalent conductance, determination of conductance, equivalent conductance at infinite dilution.

Week 5: (i) Kohlrausch's Law and ionic mobilities : Kohlrausch's Law, its applications, ionic mobilities, weak electrolytes, degree of dissociation, hydration of ions.

(ii) Conductometric titrations : Theory and experiments on Conductometric titrations.

Week 6: Debye-Hückel Theory : Theory and applications of Debye- Hückel limiting law

Week 7: Ionic equilibrium : Solubility product and activity product, solubility product from EMF, dissociation constant of weak electrolyte, ionic product, pH and pOH, salt hydrolysis and buffer solutions.

Week 8: Cyclic voltammetry and Polarography : Theory and applications.