

CHEM.774 Electrochemistry for Chemists.

Usual instructor: Prof. A. W. Addison. (AddisonA@drexel.edu).

This course incorporates both lecture sessions and laboratory opportunities.

Text sources:

- D.T. Sawyer & J.L. Roberts, "Experimental Electrochemistry for Chemists", 2nd Edn., Wiley, 1992.
- A.J. Bard & L.R. Faulkner, "Electrochemical Methods; Fundamentals and Applications", Wiley, 1980.
- P.T. Kissinger & W.R. Heineman, "Laboratory Techniques in Electroanalytical Chemistry", Marcel Dekker, 1984.
- Eds. Weissberger and Rossiter, "Techniques of Chemistry" —> "Physical Methods of Chemistry" —> "Electrochemical Methods": Wiley-Interscience. 2-4 volumes on electrochemical data and methods for analytical, organic chemistry. *E.g.*, Volume-1, Part-IIA is on various electrochemical techniques. Volume-2 is about properties of solvents - a useful lab volume.
- F.C. Anson, "Electroanalytical Chemistry", ACS Audio Course (six one-hour audio cassettes and workbook): Hagerty Library Non-Print Division, *Phonotape E387*.

- Standard potentials, Nernst eqn., spectra, stirred vs. unstirred solutions, some chemical examples & phenomena.
- Units & definitions. Faradaic processes. Coulometry. Redox indicators.
- Potentiometry, diffusion layer, iQ plots.
- Migration current, Cottrell eqn., capacitive current. Electrode & cell technology.
- Solvents, supporting electrolytes, diffusion coefficients, viscosities.
- Dropping mercury electrode polarography, Ilkovič equation.
- Rotating disk electrode, Levich eqn., Gregory/Riddiford eqn. Reversible & irreversible processes, \bar{e} -transfer rates. The ring-disk electrode, kinetics studies.
- Chronocoulometry: analyte adsorption. Double potential step chronocoulometry: reversible, irreversible and sequential processes.
- Heterogeneous \bar{e} -transfer kinetics.
- Cyclic voltammetry: Randles/Sevcik & Nicholson/Shain results for planar and spherical electrodes. Potential and current characteristics. Reversible, quasireversible & irreversible processes.
- Electron-transfer kinetics by Nicholson/Shain & Matsuda/Ayabe methods.
- CV at cylindrical electrodes by Stephens/Moorhead, Aoyagi/Matsuda & Addison models.
- CV for EC & CE processes, adsorption.
- The unfortunate consequences of solution resistance.