

Instructor Professor Shane Ardo (ardo@uci.edu)
Office Hours: Mondays @ 8 – 9 am, and 5:30 – 6:30 pm (*via Zoom*)

Meeting Times

Lecture: Tuesdays & Thursdays @ 8 – 9:20 am in **RH 192** (*no class on Th10/22, T10/27, Th11/26 (holiday); when feeling ill, use Zoom link and/or request video-recorded lecture*)
Discussion Session on Monday 10/26 @ 1 – 4:50 pm (for an additional lecture)
Final Exam Period is on Tuesday 12/8 @ 8 – 10 am (*for an additional lecture*)

"Discussion": Mondays @ 1 – 2:50 pm or 3 – 4:50 pm in **RH 453** (*hands-on lab-activity classes #2-10*)
Philosophizing on M9/28 @ 2 – 4 pm (*class #1*); *Lecture on M10/26 (class #5)*

Course Objectives

- To understand and explain the theory behind fundamental electrochemical processes
- To be able to design, perform, troubleshoot, and analyze electroanalytical experiments and data
- To quantitatively and qualitatively assess problems, and empirical data from the peer-reviewed literature
- To summarize and explain seminal and recent electrochemical peer-reviewed literature and technologies

Required Resources

Electrochemical Methods: Fundamentals and Applications (2nd edition) by A. J. Bard and L. R. Faulkner
ISBN: 978-0-471-04372-0; Chapters Covered: **A:** 1, 15; **B:** 4, 5, 2, 13, 3, 6; **Extra:** 12, 9, 10, 16, 17, 18
Peer-Reviewed Journal Articles and Additional Problems (<http://www.chem.uci.edu/~ardo/echem.html>)
Bio-Logic Potentiostat Software for **Windows** (<https://www.biologic.net/software/ec-lab-software/>)

Topics Covered (*tentative*)

- A_{1,15}** Review+ (Nomenclature, Balancing equations, Electrodes, Potentiostats, Diagrams)
A_{4,5} Mass Transfer (Nernst–Planck equation (migration, diffusion, convection), Fick’s laws of diffusion, Cottrell equation, Anson plot, Ultramicroelectrode (UME))
B₂ Thermodynamics (Electrochemical potential, Nernst equation, Underpotential deposition (UPD), Liquid-junction potential, Donnan potential, pH probe, Ion-selective electrodes (ISEs))
B₁₃ Charged Interfaces (Ionic activity, Double layer and models, Boundary layer)
B_{3,6} Electron Transfer Kinetics (Marcus–Gerischer theory, Butler–Volmer equation, Tafel equation, Catalysis and volcano plots, Cyclic voltammograms, Randles–Sevcik equation, Corrosion)
Extra Methods (Potential/Current step/sweep/pulse, Hydrodynamic RDE, Impedance spectroscopy, Scanning probe electrochemistry, Spectro-/Photo-electrochemistry)

Grading (*10% of lowest score will be dropped, leaving 90% for course grade determination*)

- 50% *Asynchronous Assignments* (8): "Lab activity" write-up and several related problems; generally due one week after odd-numbered activities (**Mondays @ noon: W10/14, 11/2, 11/16, 11/30, and 12/10**)
20% *Asynchronous Exam A* (24 hours; available **Thurs. 10/22 @ 2 pm through Thurs. 10/29 @ 8 am**)
30% *Asynchronous Exam B* (24 hours; available **Fri. 12/4 @ 2 pm through Fri. 12/11 @ 2 pm**)
0% *Synchronous Presentation:* **NONE**

Course Policies

Late assignments and make-up exams are not accepted, although *I will regrade exams upon specific request.*
Add/Drop Info (use WebReg): <https://www.reg.uci.edu/calendars/quarterly/2026-2027/quarterly26-27.html>
UCI Chemistry Enrollment Information: <https://www.chem.uci.edu/studentaffairs/>, or chemistry@uci.edu
UCI Laptop Requirements for Students: <https://www.oit.uci.edu/undergrads/laptop-requirements-students/>
UCI Academic Senate and OAISC Policy on Academic Integrity: <https://conduct.uci.edu/academic-integrity/>
UCI Human Resources Working Well Resources: <https://hr.uci.edu/partnership/workingwell/>