Electrochemistry
Fall 2017
Fitch/Loyola University Chicago
TTh 4:15-5:30; FH105
Office hours 3:15-4:15 T/Th; FH 418 (83119; afitch @luc.edu)

Content and Material

Electrochemistry is a very diverse area. It can be broadly divided into

a) **Analytical** electrochemistry which is concerned with methods of measurement involving potentiometry (pH meters etc), voltammetry, and modern sensors (generally voltammetric in nature)
b) **Physical electrochemistry** is the basis of analytical electrochemistry, but is generally concerned with the effect of electric fields, charge balance, and diffusion.
c) **Chemical electrochemistry** usually is less interested in quantitative analysis but is devoted to understanding the mechanisms of electron transfer based on chemical structure.
d) Biologic electrochemistry which can be understood as a form of physical electrochemistry (charge and fields around biomolecules) and of chemical electrochemistry (electron transfer events in biological systems)
e) Geologic and environmental electrochemistry which is concerned with all of the above as they take place in the natural environment. Of particular interest are the oxidation reduction reactions of iron, manganese, chromium, arsenic, sulfur, as these set the parameters in which life can grow and, as the oxidation state of iron has substantial implications for the stability of various minerals and their dissolution/formation.
f) Technical - in this field fall the major areas of batteries, solar energy, fuel cells, and corrosion sciences.

This class is primarily concerned with a, b, and c which will be covered in the first 2/3 of the semester. Based on student interest selected topics from d-f will be discussed.

"TextBook"

Wiley found my lecture notes from 2007 and asked me to submit a book proposal which was accepted. Consequently, in addition to the ppt lectures, you ***may*** get supplemental material which is a written description of the materials in the ppt lectures.

If you are a "book" learner and need a book, I am happy to suggest reading materials and/or loan out one or more of the common electrochemistry textbooks. I should warn you, however, that the vast majority of electrochemistry texts are highly equation driven, hence Wiley's interest in our approach to presenting electrochemical material.

Table of Contents

The chapters are arranged in order of ascending complexity of the system electrochemistry. As necessary, the appropriate research methods are introduced, with the ascending complexity. Several chapters then build upon detailed analysis of industrial system electrochemistry.

Week	Monday of Week	Topic
1	27 Aug	Introduction/Language
2	Sept 3 Labor Day	Diffusion
3	Sept 10	Inorganic Complexes
4	Sept 17	Organic compounds
5	Sept 24	Electrode materials **Exam I (consultation for project due)**
6	Oct 1	Electrolytes and Double Layers
7	Oct 8 (Mid semester break)	Modified Surfaces, Membrane potentials
8	Oct 15	Role of Solvents
9	Oct 22	Protein Controlled electron transfer
10	Oct 29	Detectors and Sensors **Exam II (second consultation due)**
11	Nov 5	More Language
12	Nov 12	Batteries
13	Nov 19	Fuel Cells
	Nov 21 Thanksgiving week	
14	Nov 26	Selected Topics
15	Dec 3	Presentations /**Exam 3**
16	Dec. 10	**Final Exam M.**

Grading and Assignments

1. Exams (Three exams) (Drop one)=200 points
2. Final Exam =100 points
3. Simulation (Each student will be assigned one simulation problem)=100 points
4. Literature Paper = 100 points (10 points for each consultation; 20 for the articles delivered; 30 for presentation; 30 for written paper; Your evaluations for presentation: 20)=scaled to 100

Grade	% of Total	500
A	92	460
A-	90	450
B+	88	440
B	82	410
B-	80	400
C+	78	390
C	72	360
C-	70	350
D+	68	340
D	60	300
F	<60	<300

Simulation

Part of understanding electrochemistry is visualizing movement of ions in response to a concentration gradient which has been established by an applied potential. In order to better understand these gradients each student will perform one simulation using an excel spread sheet. The simulations will be variable, but still reasonably simple. Students will present their simulation in class with an appropriate set of graphs to show the concentration gradients.

Graduate vs Undergraduate grades

When the semester is done I separate the UG and from G and curve the grades within the UG cohort. This should account for the fact that the G are supposedly better prepared for the level and pace of the class. Consequently the UG should assume that the grade division marks will float downward somewhat based on your cohort average.

Literature Search and Presentation=100 points

You will conduct a literature search for your article. This search should be done on **SciFinder Scholar**. http://libraries.luc.edu/research/scifinderscholar/

Example searchers are Biofuel Cells Shewanella; Electron Transfer mechanisms clays. These searches should generate somewhere between 50-100 hits. Of those hits you should be able to get 10 pdf articles via electron journal subscriptions of Loyola (http://hn9yf5lh6v.search.serialssolutions.com/) or via a request for interlibrary loan (http://pluto-lib.ls.luc.edu/illiad/logon.html). You must submit the electronic version of the 10 pdf articles to me.

Your presentation will be graded by student reviews (see attached evaluation form) and by my review weighted as follows

(0.5(average student reviews) +1.0(my review)/1.5) = pts/out of 100 pts

Late and/or Missed Assignments

No make up exams will be provided as it is difficult to reproduce equivalent materials for all students. Because no make up exam is provided one of three exams will be dropped in calculating the final grade.

Late assignments will be graded as follows:

On time 100% possible
1 week late 90% possible
2 weeks late 80% possible
3 weeks late 70% possible
No assignments accepted after three weeks.

If an assignment is late due to medical illness the student should provide third party documentation, in which case the student gets a one week reprieve before the discounting of points begins.

Presentation Evaluation Form

Date:_____

Name of Presenter:_____

Name of Evaluator: _____

	Criteria	Poss Pts	Pts
1	Did the student send materials to the class one week before the presentation?	10	
2	Did the student use power point for his/her presentation?	10	
3	In opening discussion did the presenter indicate why he/she chose this particular topic	10	
4	In opening discussion did the presenter indicate what background the various authors have in the area that would lead a reader to expect some excellence from the materials used.	10	
5	In opening discussion did the presenter read and present conclusions from any relevant prior work that was discussed?	10	
6	Was the power point legible? Clear, not too messy?	10	
7	Did the presenter indicate which data/graphs were significant in demonstrating the point the authors wished to make? (Were these graphs expanded to be projected in a form that facilitated discussion of the data?)	10	
8	Did the presenter allow for a reasonable discussion from within the group?	10	
9	Did the presenter summarize the relevant points?	10	
10	Did the presenter relate them to research to topics covered the class?	10	
	Total	100	

Constructive Comments: Please write below any comments that you feel will help the presenter in future presentations