

**53:152 - Environmental Chemistry**  
**Department of Civil and Environmental Engineering - University of Iowa**  
**FALL 2011**

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Class Meetings  
MWF 9:30 - 10:20 a.m. 3315 SC  
Office Hours:  
T: 11:00 – 12:00 *and* 1:00 – 2:00 p.m.  
R: 2:00 – 3:30 p.m. (or by appointment)

TA: Dan Allman  
Office: 1131 SC  
Email: daniel-allman@uiowa.ed

Office Hours:  
T: 2:00-3:15 p.m.  
R: 5:00-7:00 p.m.

### **COURSE OBJECTIVES**

Environmental chemistry is critical to understanding and solving problems in environmental engineering and science, such as the fate of pollutants in the environment and methods for treating both drinking water and wastewater. Basic concepts in aquatic chemistry necessary to understand these problems will be discussed including; (i) equilibrium and kinetic models, (ii) acid-base reactions, (iii) precipitation and dissolution reactions, (iv) metal complexation, (v) oxidation-reduction reactions, and (iv) adsorption reactions.

### **COURSE TEXTBOOK**

Chemistry for Environmental Engineering (5th edition) by C.N. Sawyer, P.L. McCarty and G.F. Parkin, McGraw-Hill, 1994 (SMP). *\*There will also be supplemental handout materials and notes*

*Other reference texts that might be useful:*

Water Chemistry by V.L. Snoeyink and D. Jenkins, John Wiley, 1980 (S&J).

Aquatic Chemistry (3rd edition) by W. Stumm and J.J. Morgan, Wiley-Interscience, 1996.

Water Chemistry by M.M. Benjamin, McGraw-Hill, 2002

### **COURSE REQUIREMENTS AND EVALUATION**

Quizzes, assignments, and final exam with their respective weights towards the final course grade

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Take home assignments	20%	Weekly assignments (due every Friday at the beginning of class), <b>lowest score dropped</b> , group work is fine, but hand in your own work. No late homework accepted without prior approval.
In class quizzes	60%	About every two weeks, there will be a 30 minute in-class quiz for a total of six quizzes (10% each). They will be closed-book. You may <b>miss one or drop your lowest score</b> . Makeups will only be given with prior approval obtained 3 days in advance or if there is an emergency.
Final Exam	20%	Cumulative. 7:30 A.M. Friday, December 16 in 3315 SC

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Grades will be assigned based on the following point distribution

A: 90-100 B: 80-90 C: 70-80 D: 60 – 70 F: less than 60

**COURSE TOPICS (READINGS WILL BE ASSIGNED ON EACH HOMEWORK)**

*1. Intro. to Environmental Chemistry*

- What is chemical *speciation* and why does it matter?
- Basic chemistry review – think periodic table!
- Chemical equilibrium (thermodynamics)

*2. Acid-Base Chemistry*

- What are acids and bases?
- Solving acid-base equilibrium problems
- Carbonate in natural waters: alkalinity
- Acid rain

*3. Fate of Metals*

- Complexation
- Precipitation, dissolution
- Acid-mine drainage

*4. Oxidation-Reduction Reactions*

- Predominant redox couples
- Redox potential,  $p_e$
- Eh - pH Diagrams

*5. Organics, Adsorption Reactions, and Kinetics*

- Isotherms
- Surface complexation
- Putting it all together (i.e., partitioning among air, water, & solids)
- Kinetics: How fast do these reactions occur?

**Quiz Schedule (30 minutes, closed book, 10% each)**

14 September (general chemistry/acid-base/hw 1-3)

28 September (acid-base/hw 4&5)

12 October (acid-base/hw 6&7)

26 October (acid-base, maybe metals/hw 8&9)

16 November (metals, maybe redox/hw 10-12)

7 December (redox/hw 13&14)

**FINAL EXAM : 7:30 A.M. Friday, December 16 in 3315 SC (20%)**

COURSE WEB PAGE IS ON ICON

HOMEWORK ASSIGNMENTS, LECTURE NOTES, AND SOLUTIONS WILL BE POSTED THERE