

## Water Chemistry 11:375:444

Term: Fall 2012  
Lectures: Wednesday and Friday 9:15 AM – 10:35 AM  
Location: ENR223  
Instructor: Prof. Nathan Yee  
Email: nyee@envsci.rutgers.edu  
Office hours: Wednesday and Friday 8-9 AM (ENRS room 238)  
Textbook: *Aquatic Chemistry 3<sup>rd</sup> Edition* by W. Stumm and J.J. Morgan (optional)

### Learning Goals

- Acquire in-depth knowledge of chemical processes in aquatic systems
- Use mathematical and scientific knowledge to solve geochemical problems
- Communicate technical information effectively
- Understand contemporary water contamination issues in a global and societal context

### Evaluation Criteria:

Test #1	10 %
Test #2	10 %
Test #3	10 %
Participation	20 %
Final Exam	50 %

### *Approximate Schedule*

Dates	Topic	Date	Topic
Week 1	Introduction to Water Chemistry	Week 9	Colloid Chemistry
	Chemical Thermodynamics		Chemical Kinetics
Week 2	Equilibrium Constants	Week 10	Oxidation and Reduction Reactions
	Acids and Bases		Redox Processes in Natural Waters
Week 3	Carbonate Chemistry	Week 11	Elemental Cycling and Biological Role
	Metal Ions in Solution		<i>Recitation</i>
Week 4	<i>Recitation</i>	Week 12	<b>Test # 3</b>
	<b>Test #1</b>		Class Cancelled
Week 5	Mineral Solubility	Week 13	Isotope Hydrochemistry
	Precipitation and Dissolution		Biogeochemistry
Week 6	Adsorption Reactions	Week 14	Chemical Composition of Natural Waters
	Surface Complexation Modeling		Groundwater Contamination
Week 7	Organic Contaminant Chemistry	Week 15	<i>Recitation</i>
	<i>Recitation</i>		
Week 8	<b>Test #2</b>		

## **Assessment**

### **1. Acquire in-depth knowledge of chemical processes in aquatic systems**

#### Instructional Activity:

Concepts of thermodynamics, acid/base chemistry, carbonate chemistry, aqueous/surface complexation, colloid chemistry, kinetics, redox processes, isotope hydrochemistry, and biogeochemistry will be covered in the lectures. Students will apply these concepts in homework problems and during in-class recitation periods.

#### Assessment Activity:

Knowledge of chemical processes in aquatic systems will be assessed in Test 1, Test 2, Test 3 and the Final Exam.

### **2. Use mathematical and scientific knowledge to solve geochemical problems**

#### Instructional Activity:

Students will learn how to calculate gibbs free energy, equilibrium constants, pH, dissolved ion concentrations, rate constants, redox potentials, and isotope fractionation factors. Students will use elementary algebra and chemical principals to solve geochemical problems in homework problems and during in-class recitation periods.

#### Assessment Activity:

Ability to use mathematical and scientific knowledge to solve geochemical problems assessed in Test 1, Test 2, Test 3 and the Final Exam.

### **3. Communicate technical information effectively**

#### Instructional Activity:

Students will present and discuss the solutions to homework problems during in-class recitation periods.

#### Assessment Activity:

Participation during recitation periods will be assessed. Communication of answers to specific technical questions in Test 1, Test 2, Test 3 and the Final Exam will also be assessed.

### **4. Understand contemporary water contamination issues in a global and societal context**

#### Instructional Activity:

Description and discussion of various global and regional water contamination problems, and their impact to society and human health.

#### Assessment Activity:

Understanding of water contamination issues will be assessed by student answers of specific questions in Test 1, Test 2, Test 3 and the Final Exam.