Aqueous and Environmental Geochemistry

Course Id:	CHEM 609/GEOS 633 (3 cr.)	
Lecture:	TR 11:30 – 1:00 (REIC 233)	
Instructor:	Tom Trainor	
	Rm 176 REIC	
	474-5628	
	tptrainor@alaska.edu	
Office Hours:	MW 1-2	
Grading:	Problem Sets	50%
	Mid-term	25%
	Project	25%
		100%

Course description and goals:

The goal of this course is to introduce students to the concepts and models used in aqueous and environmental geochemistry. The course content includes the characterization of aqueous geochemical environments, use of chemical equilibrium and kinetic analysis to understand the speciation of (primarily) inorganic chemical species and structural chemistry concepts applicable to low temperature mineralogy. Emphasis is placed on the study of acid-base chemistry, complexation, mineral precipitation-dissolution, reduction-oxidation reactions and sorption processes.

Student Learning Outcomes

Students will learn to utilize both graphical and computational methods for determining the speciation of multi-component aqueous geochemical systems. These skills will be developed through problem sets that emphasize problem solving skills. Students will also gain conceptual background required for critical review and interpretation of current literature in the fields of aqueous and environmental geochemistry.

Text

D. Langmuir, Aqueous Environmental Geochemistry, Prentice Hall

Additional Sources

J. Drever, The geochemistry of Natural Waters, Prentice Hall
G. Sposito, The Chemistry of Soils, Oxford University Press
W. Stumm and J. Morgan, Aquatic Chemistry 3rd ed., Wiley-Interscience
F. Morel and J. Hering, Principles and Applications of Aquatic Chemistry, Wiley-Interscience
C. Bethke, Geochemical Reaction Modeling, Oxford University Press
H.L. Ehrlich, Geomicrobiology, Marcel Deckker

Important Dates:

Jan 25	Last day for student and faculty initiated drops
March 11-15	Spring Break
March 29	Last day for student and faculty initiated withdrawals "W"
April 29	Last day of classes
Apr 30 – May 4	Final Exams

Computer Lab:
Your enrollment in this course gives you user privileges in the Department's computer lab. Information and policies are available at: *http://www.uaf.edu/chem/instrumentation/policies*

Student with Documented Disabilities:
Student with a physical or learning disability, who may need academic accommodations, should contact the Disability Services office (203 WHIT, 474-7043). Disability Services will then notify the instructor of special arrangements for course work.

Ethical Considerations:
The Chemistry Department Policy on Cheating is: "*Any student caught cheating will be assigned a course grade of F. The student will not be allowed to drop the course*."
The UAF Honor Code states: "*Student will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations. Student will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrase) in compositions, these and other reports. No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors. Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion*"

Students may collaborate on homework assignments, however, each individual should submit their own copy showing all their work. Projects are to be completed independently.

Topics

1	Introduction: basic concepts and aqueous geochemical systems, mass balance and kinetics.
2	General controls on water composition
3	Homogeneous aqueous chemistry I - acid-base - activity - alkalinity - gas exchange
4	Homogeneous aqueous chemistry II - aqueous complexes
5	Homogeneous aqueous chemistry III - redox
6	Solid phase chemistry I - compositional classes and occurrence of common soil minerals - precipitation and dissolution
7	Solid phase chemistry II - structural classification of common soil minerals - structural chemistry
8	Mineral surface properties and sorption - general sorption / partitioning - ion exchange - surface charge and surface complexation - surface charge and colloidal properties
9	Weathering and soil development
10	Surface controlled mineral growth and dissolution rates

Class projects

Class projects will involve performing a literature search for geochemical data associated with a particular system and/or process of interest (e.g. a particular watershed / river, or results of an experiment). Students will be expected to:
I) Compile data (extract / generate electronic version of data)
II) Use data to classify the system and look at correlations (as applicable)
III) Build simple models for the system of interest using data as an input

The end product will include a term paper 10-12 pages max! And an in-class presentation to share your results with the rest of the class.