Geology 205 Syllabus Spring 2008

Dr. Carl Kirby
Office: 226 O'Leary
Office Hours: open door policy; see website for schedule

TTh 9:30-10 W 1-5 O'Leary 106/103
Introduction to Geochemistry
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Required Materials: access to server for backup; calculator.
Eby, *Principles of Environmental Geochemistry*. A general chemistry text is on reserve in the Geology Seminar Room (see Ms. Mertz for a key). Other reserve readings are in my public space. A 3-ring binder is recommended for handouts.

Course requirements and grading policy
Three tests 50% (20%, 20%, 10%) Cumulative final exam 25% Laboratory grade 25%
Class participation can exert a positive influence on your overall grade.

Policies

The syllabus is subject to change, therefore the syllabus is not the final word on assignments. Changes in assignments will be announced in class, lab or by Email. You will be responsible for being aware of such changes *whether or not you attend class when they are announced*. Students are responsible for acquiring handouts distributed in class.

Take-home tests will be open-book, open-notes. All work on tests and quizzes must be solely your own. Some writing, discussion and laboratory assignments will be cooperative efforts; such assignments will be clearly designated during class. You may work with classmates on the lab exercises, but everyone must turn in a separate lab paper at the beginning of the next lab (exception: turn–in times for the reports from labs 5 and 8). **Lab assignments are not accepted late**. Notice the weight put on lab grades.

All in-class exams will be closed book; however, you may bring a "crib sheet" - an 81/2"x11" sheet of paper with as much information as you can cram into both sides. You must use only your own handwriting for this sheet. **Only if you have a serious illness (sick enough to be in bed) or other emergency (serious enough to get a note from Student Health Services) *and* if you arrange beforehand with me (leave a message with the geology department secretary if you can't reach me) will you be allowed to take a makeup exam or turn a lab or homework assignment in late**.

Dress appropriately for field trips. **You will not be permitted to go on a trip if you are wearing open-toed footware**. Old boots are recommended. Field labs cannot be made up.

Grading Scale: A > 91.99, A- > 89.5; B+ >86.5; B > 82.5; B- >79.5, C+ > 76.5; C > 72.5; C- > 70; D > 60

Keys to success in Geology 205:

If you need special accommodations for your successful completion of this class, please discuss them with me.

My schedule is posted my website. In lieu of specific office hours, I have an open door policy. If I'm in my office, 99% of the time, I'll be happy and able to speak with you. It is best to ask in person, call, or email to set up a time to make sure I haven't stepped out of the office. I try to leave a note with my location by my door if I've stepped out..

There will be two main aspects to the class. The first will be presentation and discussion of geochemical phenomena, the second will be the development of problem solving approaches, with the main stress on the latter.

The text is required, and I strongly encourage you to read the text and additional reading material before class, make notes, and bring in questions.

We will move through material quickly. Note-taking skills are important, but the time required to take notes can also impede learning. I make notes available before class; **I strongly suggest you take your own notes on the notes provided.**

Tests should be taken as follows: 1) Read all the questions, 2) describe how you would approach each problem in words and formulas (numbered steps are good) for as many problems as you can, 3) solve these problems using numbers, 4) go back to the problems you weren't sure of and approach them as above. Partial credit is the norm. Successful completion of step 2 will net you the most points. Old example tests (without keys) will be on reserve in O'Leary 102 or in my public space. **Working appropriate questions from these tests is the best way to prepare for your tests**. Study groups are encouraged, but you should practice on some of the problems on your own to simulate taking the actual test.

A good bit of work will be required outside of class. Class participation does not only mean asking questions in class. I strongly encourage you to ask questions in class, in lab, in my office or in the hallway.

I do not take attendance except for field labs, however grades correlate strongly and positively with class attendance. This is not a first-level course: I expect that your interest in the material will keep you attending regularly. Come to class unless you are really sick.

Stay engaged. Your grades will probably reflect your interest. Suggestions are always welcome. Don't forget to have fun in the process.

GEOL 205 Approximate schedule

Page #'s refer to Eby's text except: Freeze & Cherry = FC. A general chemistry text will be on reserve. **Bold** indicates class may be held in the Geology Computer Lab; outline indicates field lab. Commas separate items for a single class period; semicolons separate different topics or texts.

Date	Day		Reading for lect	LAB
Jan 17	Th	Introduction; Fields of geochemistry; Conversions, Basic Chemistry Review	1-20; refer to Gen Chem text	1 Conversions, basic chem
Jan 22-24	T-Th	Conversions, Basic Chemistry Review Free Energy, Std States, Equilibrium Constants	27-33; 35-36	2 AMD/Geochem intro (read DOE, p 6-14)
Jan 29-31	T-Th	Charge balance, Ionic strength; Activity, Debye-Hückel eqn, Ion Pairing	36-42	**3 Box Models** (20-23, 253-265)
Feb 5-7	T-Th	Gas Solubility, Solid Solubility; Bjerrum plots & CO_2 solubility	59-70	**4 Mass Balance FC 277-279**
Feb 12-14	T-Th	CO_2 solubility Alkalinity & Acidity *Take-home TEST thru solid sol'y due Friday*	75-88	**5 Carbonate Equilibria** (70-74)
Feb 19-21	T-Th	**Calcite Solubility**	70-74	6 Nippenose Valley
Feb 26-28	T-Th	Hydrolysis Diagrams **Activity-Activity diagrams**	313-323	7 **Cu Leaching/Hydrolysis**
Mar 4-6	T-Th	Electrochemistry	94-108	8 **Eh-pH Diagrams** (103-109)
Mar 8-16	Sa-S	Spring Break		No lab
Mar 18-20	T-Th	Redox in nat'l waters	108-124; Drever 287-297; 309-315	9 Acid Mine Drainage and Treatment (read DOE, p 1-31)
Mar 25-27	T-Th	Clay minerals & surface chemistry *Take-home TEST thru redox due Friday*	215-223; 341-349	10 **PHREEQCI Modeling** (read Lorah and Herman; only skim kinetics sections)
Apr 2-4	T-Th	**geochem. comp. models** Kinetics	47-50 42-47	11 Acid Precipitation
Apr 8-10	T-Th	kinetics, chemical reactors; Radioisotopes	165-169; 178-181; skim 169-178	12 Acid Mine Drainage and Treatment (read GE205 Report)
Apr 15-17	T-Th	Stable Isotopes *Take-home TEST thru radoisotopes due Friday*	181-188; skim 189-198	**13 Analyses for lab 6, 9,11, 12 in Environmental Sci Lab**
Apr 22-24	T-Th	Chemistry of Natural Waters	FC 238-254	14 **Work on labs 9 & 12 report**
Apr 29	T	Equilibrium at other T & P	33-35	No lab
May 1-8		Final exams		

Geology 205 Reading List Spring 2008

Sections of the following texts or research articles are in my public space. There is also a copy of an intro Chemistry text in the Seminar Room (O'Leary 102). See Ms. Mertz for a key.

Freeze, R. A.; Cherry, J. A. (1979) *Groundwater*, Englewood Cliffs NJ, Prentice Hall, Inc.

Drever, J.I, 1988, The Geochemistry of Natural Waters, 2nd ed., Englewood Cliffs NJ, Prentice Hall, Inc.

Watzlaf, G.R., Schroeder, K.T., Kleinmann, R.L.P., Kairies, C.L. and Nairn, R.W., 2004, *The Passive Treatment of Coal Mine Drainage*, **DOE**/NETL-2004/1202. Available from: http://www.netl.doe.gov/technologies/coalpower/ewr/water/pdfs/Passive%20Treatment.pdf., accessed August, 2007.

Lorah, Michelle M.; Herman, Janet S. (1988) The chemical evolution of a travertine-depositing stream: Geochemical processes and mass transfer reactions, *Water Resources Research*, 24, 9, 1541-1552.

Jenson, A.; Kassab, C.; Palmer, M; Schroeder, A; Sepsy, R., 2006, Review and Remedial Repairs of Carbon Run Abandoned Mine Drainage Treatment Project: A Report to the Shamokin Creek Restoration Alliance and the Northumberland County Conservation District, Geology 205 lab report, Dec. 12, 2006.