

Aquatic Chemistry
CHEM 3411
Winter Quarter, 2006

Instructor Dr. Keith Miller
Office: SGM 105
Contact info: phone: 303.871.7721; email: kmiller3@du.edu
Class Time: MW(F) 10:00 – 10:50
Class Location: Olin 204 (Chemistry conference room)
Office Hours: By arrangement

REQUIRE COURSE ITEMS

Textbook: *The Geochemistry of Natural Waters*, 3rd ed., James I. Drever (1997) Prentice-Hall, Upper Saddle River, NJ (available at the DU Bookstore).
Calculator: An inexpensive calculator is required. It should have the capabilities for square roots, logarithms, and exponential (scientific) notation operations. The calculator will be used for problem sets, quizzes, and exams. You are responsible for understanding how to perform each of the operations on your calculator. **Remember to bring your calculator (or laptop) with you to every class.**

SUPPLEMENTAL COURSE ITEMS

Citizen's Guide to Colorado Water Quality Protection, Colorado Foundation for Water Education (2003) Denver, CO (handout provided).
Study and interpretation of the chemical characteristics of natural water, 3rd ed., J.D. Hem (1985) U.S. Geological Survey Water-Supply Paper 2254 (28 MB pdf file available).
National Recommended Water Quality Criteria, US Environmental Protection Agency (2004) (pdf on class website)

Other EPA and Colorado State weblinks will be available on the class website.

COURSE DESCRIPTION

This course will cover advanced topics in aquatic chemistry, specifically as they apply to natural waters. The material will be off of concepts in Analysis of Equilibrium Systems (CHEM 2011), and will include topics in chemical equilibrium, solubility, dissolution, weathering processes and redox equilibria. Included in the course will be significant coverage of water quality of surface and ground waters including a course-long project that evaluates the water quality of Sand Creek. While no formal lab component is associated with the course, we will spend time in the field to complete the Sand Creek project.

CLASS MEETINGS

The class is scheduled to meet MWF. However, Friday meetings (with the exception of Jan 6 and 20) will be "planning/work" days. On these days, no formal lecture will be held. We will use these days to visit the Sand Creek Greenway, perform water quality analysis, or discuss our project.

TOPICS

- Introduction; hydrologic cycle, water quality
- Equilibrium review, activities, species Distribution, pH-C diagrams
- Carbonate system, buffering
- Clay minerals, adsorption processes, organic compounds
- Redox equilibria, solubility, kinetics, weathering
- Special topics – acid mine drainage, isotopes

READINGS

You are expected to complete the assigned reading prior to the class lecture. I recommend that you understand the material and how to solve the sample problems before proceeding to the next section. I will assign readings (and suggested problems) on a weakly basis. Additional readings from secondary sources will also be suggested. It is often very helpful to read similar material from different texts.

PROBLEM SETS

Problem solving is an important component of all chemistry and most science courses. I will post suggested problem sets throughout the course. These problem sets will be graded. You are encouraged to work together to complete the problem set; however, the work you turn in must be your own. The problem sets will be due exactly one week from the time they are assigned. Late assignments will be deducted 10% points each calendar day they are late. These problems are typical of those you might encounter on the exam.

CLASS PARTICIPATION

I expect everyone to fully participate in class discussions and on the class water quality project. At times, we will discuss the water quality issues surrounding Sand Creek during class. Preparation is crucial from everyone since one of the outcomes of this class is to produce a report for the Sand Creek Regional Greenway. On occasion, quizzes will be administered to make sure everyone has prepared for class. In addition, a percentage of the grade for the water quality project will also be based on participation of each individual.

EXAMS

One midterm and final exam will be given. These exams will both be take-home exams. You are required to work on these by yourself. The exact due date for the exams will be indicated on the exam when they are handed out. **NO LATE EXAMS WILL BE ACCEPTED.** If you will be out of town for a University sanctioned function (e.g., athletic team or music group), you are responsible for making arrangements with Dr. Miller at least one week in advance to complete the exam ahead of the due date.

WATER QUALITY PROJECT

A significant portion of the course will be devoted to completing a water quality assessment of Sand Creek. Details on the project will be given in the first week of the course. The intent of the project is to learn the principles of water quality monitoring and analysis, as well as the regulatory environment protects the quality of our nation's water. I have chosen to accomplish this by having our class act as "consultants" to the Board of Directors for the Sand Creek Regional Greenway. I will be attending the board meeting on January 5th to meet with the board (all of you are invited to attend also). Details of the class project will be finalized after this meeting. Each of you will be in

small groups (2-3) that will work on different aspects of the project. The project will include trips to the greenway for observations and water sampling, possible discussions/interviews with board members, sampling plan development, analysis of water samples, evaluation of the data, and a final deliverable (written report and/or presentation). The final report will be submitted to the Board at the completion of the course and will be a part of your grade. Each individual will be expected to participate fully in the process (a portion of your grade will be based on participation as assessed by the instructor and your classmates). Significant time outside of class will be required to complete this project successfully. This is not an analytical chemistry course, so I will not be expected to be experts in all aspects of instrumentation. I will provide support here as needed. I will, however, expect you to understand the principles behind all analyses.

GRADES

At the end of the quarter, you will be graded according to your performance on the problem sets, exams, class participation, and the water quality project. Cooperative learning is encouraged. As such, I will not grade on a curve. Your final grade will be determined by the point totals with the following components:

| <u>Component</u> | <u>Points</u> |
|-----------------------|---------------|
| Problem Sets/Quizzes | 100 |
| Exams | 200 |
| Water Quality Project | 300 |
| Total Points | 600 |

CELLULAR PHONE AND PAGER POLICY

I respect the need for each individual to stay in contact with family and friends. The use of cellular phones and pagers, however, is disrupting to the learning environment. Thus, I request that the ringers of all cellular phones and pagers be muted during class. If an emergency arises, and you need to make a call on your phone, I request that you quietly leave the room and conduct your conversation out in the hallway.

LECTURE AND TESTING ACCOMODATIONS

I will make every effort to accommodate students diagnosed with a learning disability. I will do this in complete confidence. I do, however, request that any student requiring these accommodations inform me the first week of class. For further information, please see the University Disability Services' website at <http://www.du.edu/disability/dsp/index.html>.

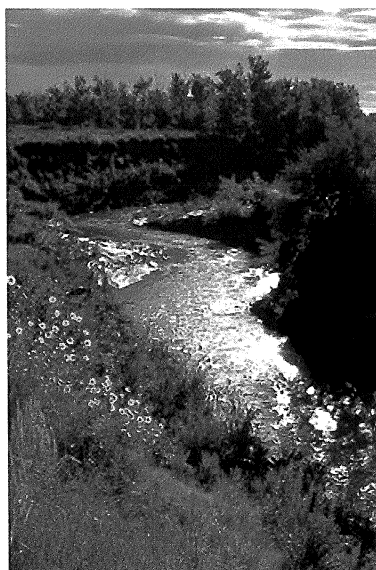
ACADEMIC DISHONESTY

While I advocate collaborative learning and teamwork, I also firmly believe that each individual should maintain the highest ethical standards in all of life's endeavors. As such, I support and will strictly enforce the Honor Code of the University of Denver. For your reference, I have included the links for the Honor Code Statement and Honor Code Procedures for Students below. For further information, please see the Office of Citizenship & Community Standards' website at <http://www.du.edu/honorcode/statement.htm> for the Honor Code Statement and at <http://www.du.edu/honorcode/studentprocedure.htm> for the Honor Code Procedures for Students.

NEW ENVIRONMENTAL CHEMISTRY COURSE for WINTER 2006

Aquatic Chemistry
CHEM 3411:Environmental Chemistry II
Instructor: Dr. Keith Miller
CRN: 3706
Times: To be arranged

- What processes determine the composition of natural ground and surface waters?
- How do industrial, agricultural, recreational and homeowner activities impact the quality of these waters?
- What impact do impaired waters have on local, national and global communities?



Find the answers to these questions and more next quarter in CHEM 3411! The course will use Sand Creek Regional Greenway as an "outdoor classroom" as we studied the impacts of the redevelopment of Stapleton and Fitzsimmons on Sand Creek.