

GG325 -- GEOCHEMISTRY
Fall 2012

Course Meets: MWF, 0930-1020AM POST 708

Prerequisites: GG 200, GG250, MATH 241 or MATH 251A, CHEM 162 (or concurrent)

Instructor: Ken Rubin

How to find me:

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Office: POST 606E; **Office hrs:** up to the class.

Phone: x68973, x66836 (lab)

Course Content:

This course focuses on the chemistry of the natural world and the chemical evolution of the Earth over geological time. We will discuss practical and theoretical geochemistry, with an emphasis on how chemical principles are used to study Earth Sciences. The course is composed of a three modules: (a) geochemical fundamentals; (b) natural and anthropogenically perturbed aspects of the Earth's hydrosphere and its interaction with surficial rocks, sediments, soils, the biosphere and the atmosphere and (c) the origin and evolution of Earth (crust-mantle-core) and the solar system through nuclear and high temperature chemical processes.

Geochemical Fundamentals

- The Elements; basic principles of inorganic chemistry, periodic properties
- Thermodynamics and chemical reactions, solubility
- Aquatic Chemistry, pH-pE, Biology and redox
- Organic Chemistry

Low temperature geochemistry - The hydrologic cycle

- Chemical Processes, Photosynthesis/respiration, Aquatic Microbial Biochemistry in rain, rivers, lakes, estuaries

Low temperature geochemistry - Sedimentary geochemistry

- Chemical weathering, soil formation, geochemistry of clays.
- The oceans, marine chemistry, primary productivity, Gaia, Marine Sediments: a record of environmental global history, light isotope geochemistry.
- Global Climate: Present and Future, atmospheric CO₂

High temperature geochemistry - Planetary geochemistry

- Age and Origin of the Solar System.
- Planet formation, differentiation of the Earth.
- igneous processes
- Radiogenic isotope geology/Geochronology

GG Learning Objectives:

GG department has defined 5 learning objectives for the undergraduate degree program related to Relevance of Geology and Geophysics, Technical knowledge, Scientific method, Oral and written skills, and Evaluating Phenomena. This course directly incorporates content relevant to 4 of those:

- SLO1 - throughout the course you will learn about the relevance of geochemistry to understanding and providing for human needs, and to impacts on society and planet Earth.
- SLO2 - you will solve problems using real world data sets
- SLO4 - you will reconstruct knowledge in a written report (final project).
- SLO5 - in all assignments you will evaluate, interpret, and summarize basic principles to explain complex phenomena at the interfaces of chemistry, geology, biology, hydrology, soil science, geography and human industry.

Course Goals:

This class is about using chemical information and chemical reasoning to better understand geological, hydrological and biological process and their interplays on Earth. We will use quantitative and qualitative approaches to learn how the compositions of Earth materials constrain active processes and Earth history.

Assessment and Grading:

You will have a variety of exercises this semester to help you learn the material and demonstrate as much. I use points and then assign grades at the end of the semester using a "semi-curve" (i.e., I don't base grades on the standard 90%=A, 80%=B, etc. formula, but instead, compare overall class performance and the performance of highest and lowest scoring assignments to devise a scoring formula). If you are ever concerned about your performance in the class, come by my office and speak with me. Although I don't assign letter grades until the end of the semester, I can tell you at any time approximately "how you stand". Class participation/attendance is not mandatory, but it can make the difference in borderline grading situations. Grades will based on:

- a. midterm exam (25%)
- b. problem sets (30%)
- c. course journal (20%)
- d. written final project (25%).

Please turn assignments in on time. *Grading penalties of 10% per day will apply unless a valid reason for a late assignment is discussed with me ahead of time.*

Text:

Reading assignments will be provided from various text books FOR FREE. *Reading will likely take 2-3 hours per week.*

Class Format:

This is a lecture course. I encourage you to actively ask questions in class, particularly if you do not understand something I am discussing. Most of the important material will be discussed in class, but is also typically covered in more detail in the reading assignments. It will help you get the most out of the lectures If you keep up with the reading.

Lecture Notes:

These are available for students to download (usually the day before the lecture) from www.soest.hawaii.edu/krubin/gg325.html. These are not required reading, nor are they a substitute for taking your own notes. They are meant to be a guide to lecture content.