

Geology 4490-01 - Geochemistry – Spring 2013
Tuesday and Thursdays 11:00-12:15 Geology 209

| <u>Instructor</u> | <u>Office</u> | <u>e-mail</u> | <u>Phone</u> | <u>Office hours</u> |
|-------------------|---------------|--|--------------|---|
| Dr. Kenneth Sims | GEO 314 | ksims7@uwyo.edu | 766-3306 | M 1:30-2:45 PM T. 9:00-10:00 AM Thur 2:45-3:30 PM By appointment |

| <u>Teaching Assistant</u> | <u>Office</u> | <u>e-mail</u> | <u>Office hours</u> |
|---------------------------|---------------|--|------------------------|
| Caroline Lo Re | GEO 316 | flore@uwyo.edu | W 10-12 Thur 9-11AM |

CONTACT:

You always should feel free to contact me (or Caroline) about the material presented. When emailing us use a clear distinct subject header. Please do not call us at home or by cell phone.

CLASS CONDUCT:

No interrupting. Focus on the person with the floor. No eating in class. No electronic devices (laptops, I-pads or cell phones) in class; paper and pencil only.

COURSE DESCRIPTION:

The objective of this course is to develop a quantitative and thorough understanding of the systematics and application of geochemical principles to the study of earth systems. During this course you will be introduced to the following topics:

Fundamentals

- * Nuclear Chemistry
- * Thermodynamics of Geochemical Processes
- * Kinetics of Geochemical Processes
- * Acid, bases and chemical weathering

Essential Tools of Geochemistry and their applications

- * Trace Element Behavior
- * Radiogenic and Stable Isotopes
- * Phase Equilibria

Geochemical Processes

- * Nucleosynthesis
- * Planetary Formation
- * Earth Differentiation and Structure
- * Geochemical Cycles on the Earth's Surface

Lecture Notes: Can be downloaded at University of Wyoming's eCompanion site.

TEXT(S) AND READINGS:

Geochemistry. White, W., This is available free of charge on the course web site at University of Wyoming's eCompanion.

Essentials of Geochemistry (2009) Walther, J. V. 2nd Ed. Jones & Bartlett Publishers. 797 pp.

COURSE REQUIREMENTS/ASSIGNMENTS:

HOMEWORK: There will be four homework problem sets. Each individual is expected to work on these problem sets on his or her own. You will be asked to sign an honor code at the end of every homework stating that you have neither given nor received help from anyone, either in the class or outside the class. Nor do you know of anyone giving or receiving help. You can discuss concepts with each other, but “walk the line of integrity” and do not work on the homework with others. Come see me for help.

No late assignments will be accepted without an official University excuse! Grading will be on a standard scale (90s = A, 80s = B, etc.). Individual assignments will not be curved.

TESTS: TESTS MUST BE TAKEN ON THE SCHEDULED DATE. Make-up exams will be given only to students with an official University excuse, and exams must be made up within one week after returning from an excused absence. Grading will be on a standard scale (90s = A, 80s = B, etc.). Individual exams will not be curved.

Note the dates for exam schedule and final. No electronic devices during the exam.

Tests are all inclusive/comprehensive.

CLASS PARTICIPATION: Two Metrics:

1) There will be “In-Class Quizzes” worth 1 point each once a week. These quizzes will be short and will be graded bi-modally (0 or 1 point). In total these quizzes will be worth 10% of your grade, with an extra three points possible.

2) Each lecture someone will be chosen randomly and asked to come to the board to review the previous lectures concepts.

GRADING: There are 100 points possible in this course. The following is a break down of the grade assessment.

| | |
|---|-------------------|
| Lab/Homework: | 40 points |
| Final Exam: | 20 points |
| Two Mid Term Tests | 30 points |
| (Best normalized to 20 points, worst normalized to 10 points) | |
| In-Class Quizzes | 10 points |
| (Each is worth 1 point, once a week; three extra points possible) | |
| TOTAL POSSIBLE POINTS | 100 POINTS |

IMPORTANT ASSESEMENT DATES:

Problem sets due: February 15, March 15, April 12, and April 26

Tests: February 21, March 28, and a “Final Exam” on May 9th

OBLIGATORY MESSAGES FROM THE DEAN:

- 1) **Cheating.** University Regulation 802, revision 2, defines academic dishonesty as “an act attempted or performed which misrepresents one’s involvement in an academic task in any way, or permits another student to misrepresent the latter’s involvement in an academic task by assisting the misrepresentation.” There is a well-defined procedure to judge such cases, and serious penalties may be assessed. In this class, your exams and homework are expected to be your work ONLY.
- 2) **Conduct.** University Regulation 29, change 1, states that the instructor can “establish reasonable standards of conduct for each class which should be made known at the outset.” In this class I expect engagement and participation, including regular attendance, and that we all treat each other with courtesy and respect. This does not mean we have to agree with each other!
- 3) College of Arts and Sciences document, **A&S - Students and Teachers Working Together**. A 5-page document is available at:

uwadmnweb.uwyo.edu/a&s/Current/students_teachers_work.htm

This document lays out the guidelines for the course syllabus, attendance, classroom deportment (no sleeping or cell phone use!), phone and email protocol, office hours and how to make appointments outside of office hours. Good stuff.
- 4) **Disabilities.** If you have a physical, learning, or psychological disability and require accommodations, please let the instructor know immediately. You will need to register with, and provide documentation of your disability to, University Disability Support Services (UDSS) in SEO, room 330 Knight Hall, 766-6189, TTY: 766-3073.

COURSE SYLLABUS

| Week | Dates | Topic | Reading¹ | Homework |
|-------------|------------------------|---|--|--|
| 1 | Jan 15 & 17 | Periodic table; electronic structure of atoms; chemical bonds; ionic radii, and crystal chemistry | <i>Walther</i> Chapter 1 and 5 <i>White</i> Chapter 1 | |
| 2 | Jan 22 & 24 | Isotope principles: fusion, fission and radioactive decay (note this will include a differential calculus review of 1st order differential eqs. | <i>Walther</i> Chapter 10 <i>White</i> Chapter 8 | |
| 3 | Jan 29 & 31 | Stellar Nucleosynthesis | <i>White</i> Chapter 10 | |
| 4 | Feb 5 & 7 | Formation of the solar system; age of the solar system; formation of the planets; age of the earth | <i>White</i> Chapter 10 | |
| 5 | Feb 12 & 14 | Earth structure and differentiation, mantle structure and composition | <i>Walther</i> Chapter 2 <i>White</i> Chapter 11 | HW 1 due FRIDAY Feb 15 |
| 5 | Feb 19 & 21 | Review Session Test 1 Thursday Feb 21 | <i>None</i> | HW 1 returned Feb 19 |
| 6 | Feb 26 & 28 | Differential Calculus Review II (PDEs) Thermodynamics | <i>Walther</i> Chapter 1, 3, 4 <i>White</i> Chapter 2, 3, 4 | |
| 7 | Mar. 5 & 7 | Thermodynamics | <i>Walther</i> Chapter 1, 3, 4 <i>White</i> Chapter 2, 3, 4 | |
| 8 | Mar 12 & 14 | Kinetics and Diffusion (Rates of Reaction) | <i>Walther</i> Chapter 13 <i>White</i> Chapter 5 | HW 2 due FRIDAY Mar 15 |

¹ Reading assignments should be completed **before** class on the day listed.

| Week | Dates | Topic | Reading¹ | Homework |
|------------------------|---------------------------------|---|--|--|
| 9 | Mar 18 & 22 | <i>no classes- spring break</i> | | <i>Spring Break</i> |
| 10 | Mar 26 & 28 | Review Session Test 2 Thursday (March 28) Comprehensive | | HW 2 returned March 26 |
| 11 | April 2 & 4 Advising Week | Magmatic Processes: partial melting and fractional crystallization | Walther Chapter 5 and 8 White Chapter 7 | |
| 12 | Apr 9 & 11 | Formation of oceanic and continental crust. Radiogenic Isotopes: Earth Evolution | Walther Chapter 2 White Chapter 8 | HW 3 due FRIDAY Apr 12 |
| 13 | Apr 16 & 18 | Stable Isotopes Oxidation and Reduction | Walther Chapter 11 and 14 White Chapter 9 | HW 3 returned Apr 16 |
| 14 | Apr 23 & 25 | Acids and Bases and geochemical weathering Stream and ground water chemistry. | Walther Chapter 6 and 7 White Chapter 6 | |
| 15 | Apr 30 & May 2 | Geochemical processes in hydrothermal systems. Geochemical cycles recorded in ocean waters and sedimentary rocks. | Walther Chapter 7, 9, 11 | HW 4 due Apr 30 Homework 4 returned May 3 |
| Finals Week | May 9 | Final (Comprehensive) | | |

The instructor reserves the option to make changes to the schedule (particularly the readings) throughout the course. Changes will be announced, with plenty of leadtime, either in class or via e-mail.