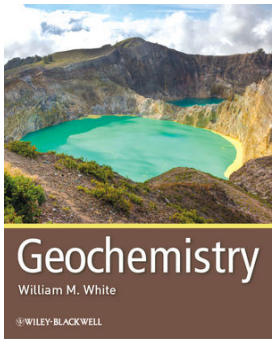
Geochemistry of Environments 51-369 Fall 2022
Section: 001C



Instructor: Dr. Ben Hallett
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Office Hours: Thu 1:45–3:15pm, Fri 1–2:30pm
IN HARRINGTON 216
or by appointment (email Dr. Hallett)

Description: Quantitative and qualitative study of chemical interactions of earth's interior and environments on earth's surface. Mineral-water interactions, chemical weathering, and solution chemistry of waters in earth environments. Behavior of naturally occurring elements, stable and radioactive isotopes, geochronology, analytical techniques, thermodynamics of reactions, geothermometry and geobarometry.

Prerequisites: Geology 102, 110 or 150; Chemistry 105; and Math 104 with a grade of C or better or placement into Math 106 or higher. Chemistry 106 is recommended.

Class Schedule: Lectures MWF 9:10-10:10am, Harrington 217 (see detailed schedule)

Required Textbook: ***Geochemistry*** by William White, (Wiley-Blackwell; ISBN: 9780470656686). Please note that this textbook contains a very detailed introduction to the comprehensive field of geochemistry. In this course we will not get to a level of detail that this book provides, appropriate for a graduate level course in geochemistry. The book, however, will be a superb reference volume for finding more in-depth information on a variety of topics that may interest you.

In addition to the textbook, we will read some of the primary literature (scholarly journal articles) of geochemistry and its applications. You will also be asked to use journal databases to find primary literature sources. Reading assignments will be announced in class and posted on Canvas.

Course Objectives: This course is about the chemical systems and processes of the planet we live on. It covers a diverse group of topics in both chemistry and geology with specific objectives:
1) to help students develop skills in chemistry that are useful in studying earth systems, materials, and processes.
2) to provide students with insight into the greater interactions of material within the solid earth (rocks, fluids, magma) and the material at its surface (oceans and atmosphere).
3) to introduce students to the geochemical tools and approach that can be applied to a number of different problems in geology and environmental science.

Course Components:
In-Class Activities include answers to questions and accompanying calculations, based on problems shown in class. These are done in randomly assigned groups/pairs. You must have a calculator, pencil, and paper for each lecture for calculations. Additionally,

we will be using **Google Sheets and Microsoft Excel** in class for a number of exercises, so you may be asked to have access to this software on your computer. Unless otherwise noted, in class exercises are due at the end of class. **Late work will not be accepted.**

Homework will be assigned periodically throughout the semester with a focus on solving geochemical problems with applications to different types of earth processes and materials. Assignments that include calculations need not be typed unless stated, but **should be complete, legibly written**, **in numerical order, and easy to follow**. Assignments will be submitted on paper (printed and stapled). **Late work will not be accepted.**

Weekly Quizzes are given during Monday lectures. Timed quizzes will be short (≤5 questions) and will cover key material from **the preceding week's lectures and/or reading**. Quizzes may include a written reflection about an application or a geochemical principle. Your semester quiz grade will be based on all but your lowest 2 quiz scores.

Exams will be take-home. Your two highest scores will count for 20% of your grade, and the lowest score will be devalued to 15%. The exams test your ability to grasp concepts and solve problems rather than memorize formulas or vocabulary. However, if you fail to take good notes, participate in class, or gain a reasonable grasp of the material you will struggle with the exams.

The tentative exam schedule (subject to change) is:
Exam 1: assigned October 10, due October 14
Exam 2: assigned November 14, due November 18
Exam 3: assigned December 7, due December 14

Attendance/Participation: The material on the exams will come from the lecture, homework, and in-class exercises so attendance is required if you wish to do well in the course. Please feel free to ask questions at any time, including during lecture; however, disruptive behavior, including talking during lecture or text messaging, is not acceptable and will result in a lower course grade.

Grades: Your course grade will be based on three lecture exams (55%), homework and projects (20%), in-class group exercises (15%), quizzes and attendance/participation (10%)

Grade scale: 93% and up = A; 90–92 = A-; 87–89 = B+; 83–86 = B; 80–82 = B-; 77–79 = C+; 73–76 = C; 69–72 =C-; 66–68 = D+; 63–65 = D; 60–62 = D-; <60% = F

Special Accommodations: Reasonable accommodations will be made for students with disabilities. Please contact Disability Services (424-3100 (voice) or 424-1319 (TTY)) or visit their web site at http://www.uwosh.edu/dean/disabilities.htm for the University's accommodation request form and documentation requirements. Information related to an individual's accommodation request will be kept confidential.

Course Outline: SUBJECT TO CHANGE

Wk	Week of	Topic	Reading (White)	Class Activ.	Notes
1	Sep. 5	introduction, units	1.1–1.3, 1.5	IC1	
2	Sep. 12	atoms, elements, bonds	1.4, 7.1–7.2	IC2	
3	Sep. 19	systems, energy and the first law of thermodynamics	2.1–2.5	IC3	
4	Sep. 26	the second law, entropy and free energy	2.6–2.11	IC4	
5	Oct. 3	chemical potential, solutions, K_{eq}	3.1–3.5, 3.9	IC5	
6	Oct. 10	applying thermodynamics, geothermobarometry	4.4–4.5		Exam 1 due 10/14
7	Oct. 17	acid–base reactions, pH	6.1–6.2	IC6	
8	Oct. 24	dissolution, precipitation,	6.4	IC7	
9	Oct. 31	clay minerals, isotopes, radioactivity and geologic time	6.5, 8.1–8.3		
10	Nov. 7	isochrons, decay systems and applications	8.3–8.4	IC8	
11	Nov. 14	isotope ratios and petrogenesis	8.4.2–8.4.3		Exam 2 due 11/18
	Nov. 21	trace elements and sampling	TBA	IC9	TG Break
12	Nov. 28	tracers and analytical geochemistry	7.3–7.4, 7.6		Mini Projects
13	Dec. 5	stable isotopes & applications	9.1–9.2, 9.4, 9.6	IC10	
14	Dec. 12	stable isotope thermometry	9.3	IC11	Exam 3 due 12/14

Important dates: 9/7/22 class begins; 9/13/22 last day to add without instructor's signature; 10/4/22 last day to add with instructor's signature; 10/4/22–10/10/22 Early Alert; 10/21/22 last day to drop without Late Drop Request Form or withdrawal; 11/23/122–11/27/22 Thanksgiving Break; 12/16/22 Classes end.

Academic Integrity: The Wisconsin Administrative Code states: "Students are responsible for the honest completion and representation of their work, for the appropriate citation of sources, and for respect of others academic endeavors." (§ UWS 14.01) Plagiarism and other forms of academic misconduct are serious offenses with severe penalties. See the University of Wisconsin Oshkosh Student Discipline Code for definitions of academic misconduct and details about procedures, sanctions, and other relevant information: http://www.uwosh.edu/deanofstudents/university-polices-procedures/academic-misconduct. Specific questions about the Student Discipline Code should be directed to the Dean of Students Office. If you do not understand this statement, please see me as soon as possible.

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Disclosure Statement: Students are advised to see the following URL for disclosures about essential consumer protection items required by the Students Right to Know Act of 1990: https://uwosh.edu/financialaid/consumer-information/