Introduction to Geochemistry (GLY 308)
University at Buffalo

Instructor: Dr. James Boyle
Email: jamesboy@buffalo.edu
Office: Cooke 453
Lectures: MW 9:00AM-9:50AM**,** Cooke 434
Recitation: F 9-10AM or 10-11AM, Hochstetter 430
Student Hours: Tu/Th 11:00AM-12:00PM, or by appointment

Teaching Assistant: Amy Grogan
Email: amygroga@buffalo.edu
Office: Cooke 247
Student Hours: Tu 9:30-11:30AM

Course Description: This course provides an introduction to how chemistry can be used to interpret and explain geologic phenomena in both deep time and the modern day. It is designed to allow students to use basic concepts of a general chemistry course to geologic problems. The course will introduce geochemical applications in a variety of subdisciplines including radiometric dating, environmental, and paleoecological which may be explored further in upper level courses.

Course Objectives and Learning Outcomes: The purpose of this course is to teach students how to apply general approaches of chemistry to geologic problems and encourage development of a more flexible view of data analysis.
At the end of this course you should…

1) Be able to discover and integrate new information about geochemistry and its applications to your current knowledge base
2) Be able to identify the proper thermodynamic laws and relationships of geochemistry to solve geologic problems
3) Develop quantitative approaches and applications to data analysis of geochemical data
4) Be able to identify and articulate implicit assumptions of geochemical analysis and assess whether those assumptions are likely to be violated

Assessment of Learning Outcomes:

LEARNING OUTCOMES		**OUTCOME ASSESSMENT**
1	Discover & integrate new information	Participation, Problem Sets 1-7, Quizzes, Exams
2	Identify and apply appropriate geochemistry tools	Participation, Problem Sets 1-7, Quizzes, Exams
3	Develop quantitative skills	Participation, Problem Sets 1-7
4	Develop and apply simple models in excel	Problem Sets 1-7
5	Synthesize existing & new knowledge for critical thinking	Problem Sets 1-7, Quizzes, Exams

Required Text: *Introduction to Geochemistry: Principles and Applications*, 2012, Kula Misra, Wiley

Supplemental Texts (On reserve in Lockwood**):** Faure (1998) *Principles and Applications of Geochemistry*, 2nd ed; Faure and Mensing (2005) *Isotopes: Principles and Applications*

Top Hat: We will be using the Top Hat (www.tophat.com) classroom response system in class. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message.

You can visit the Top Hat Overview (https://success.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide) within the Top Hat Success Center which outlines how you will register for a Top Hat account, as well as providing a brief overview to get you up and running on the system.

An email invitation will be sent to you by email, but if don't receive this email, you can register by simply visiting our course website: Unique Course URL
Note: our Course Join Code is 008690

Top Hat may require a paid subscription, and a full breakdown of all subscription options available can be found here: www.tophat.com/pricing.

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their Support Team directly by way of email (support@tophat.com), the in app support button, or by calling 1-888-663-5491.

Course Requirements and Expectations:

- I will post assignments to UBLearns and it is ***your responsibility*** to check the course site.
- You will to be respectful to your fellow students.

Policies and Practices

- ***Assignments and other relevant course content will be posted on UBLearns***. You are responsible for all course materials and information posted on UBLearns.
- ***You must be present and engaged in class to get full credit*** for the course so it is in your best interest to come to every class.
- ***All assignments are due at the beginning of recitation***, unless noted otherwise. We will use Microsoft Office products (free to UB students) throughout class.
- ***All assigned reading preparation must be completed before the beginning of class***. This will enable you to make the most from the lecture and recitation sessions and will help them to run smoothly and efficiently. Failure to be prepared will affect your grade.
- ***Use your UB email address*** for email communication. If you do not regularly check your UB email address, please forward the mail to the address that you check regularly.

- ***All emails need to have the course number in the subject title*** (I have 3 courses to keep track of).

Course Structure

Recitation is an integral part of the class. Students are responsible for all material presented in both lectures and recitations.

- Lectures will present theory, examples, and discussions
- Recitation will be coached problem-solving activities and assignments that reinforce methods, applications, and concepts
- Exams and quizzes will occur during recitations

Grading

The specific details regarding grade distribution are as follows (and are subject to change):

Grade Percent		**Grade scale (%)**			
Class Discussion/Exercise:	15%	A	94-99	C	74-77
Problem Sets:	30%	A-	90-93	C-	70-73
Quizzes	25%	B+	88-89	D+	68-69
Exam I	15%	B	84-87	D	65-67
Exam II	15%	B-	80-83	E	<65
		C+	78-79		

Assignments

Class Discussion/Exercises: At least once a week we will have either a discussion on the topics of the week or a short set of problems to actively develop your skills during class. These grades will be largely participatory so it is in your best interest to come to class.

Problem Sets: Approximately biweekly you will be assigned problem sets to do outside of class time that will be a combination of calculations using Excel and interpretation of the data. Problem sets will be posted on UBLearns at the beginning of the week they are due and answers submitted to UBLearns by 9AM under the assignments tab on Friday, regardless of your recitation section. Each problem set will be approximately 5% of your total grade. Late submissions will receive a zero, except with documentation of a medically excusable absence or by prior written arrangement.

Quizzes: There will be several quizzes throughout the semester. Quizzes will be based on material presented in lecture, readings, problem sets, and class discussions. Missed quizzes will receive a zero, except with documentation of a medically excusable absence or by prior written arrangement. Each quiz will be approximately 5% of your total grade.

Exams: Exams will be a combination of short answers, with calculations, and multiple choice. Exams will be held on March 13th and May 8th during recitation. **There is no exam during exam week**.

Make-up Policy: The class discussions/activities, quizzes, and problem sets cannot be made up, except under unusual circumstances. In cases where illness or other unforeseen circumstances prevent you from being in the classroom you may be excused from the class discussion/activity, quizzes, and problem sets only after contacting me. If circumstances arise that you are unable to be on campus on an exam day you

MUST contact me as soon as possible and provide proof of why you were absent before you will be allowed to take the exam.

Notice of Non-Discrimination*:* The University at Buffalo is committed to ensuring equal employment, educational opportunity, and equal access to services, programs, and activities without regard to an individual's race, color, national origin, sex, religion, age, disability, gender, pregnancy, gender identity, gender expression, sexual orientation, predisposing genetic characteristics, marital status, familial status, veteran status, military status, domestic violence victim status, or criminal conviction status. Employees, students, applicants or other members of the University community (including but not limited to vendors, visitors, and guests) may not be subjected to harassment that is prohibited by law or treated adversely based upon a protected characteristic.

Academic Integrity: Academic integrity is a fundamental university value. Through the honest completion of academic work, students not only advance their educational objectives, they sustain the integrity of the university and facilitate the transmission of knowledge and culture based upon the generation of new and innovative ideas. The Undergraduate Academic Integrity Policy provides additional information about what UB considers to be academic dishonesty and the possible consequences for violating UB's policies on academic integrity. In particular, you should be sure that you are aware of what UB considers to be academic dishonesty and that you understand how to avoid academic dishonesty. If you are unsure about the meaning of any of this information please talk to me or your academic advisor about them and we will try to clarify our expectations.

Accessibility Resources: If you have any disability which requires reasonable accommodations to enable you to participate in this course, please contact the Office of Accessibility Resources, 60 Capen Hall, 645-2608, and also the instructor of this course. The Office of Accessibility Resources will provide you with information and review appropriate arrangements for reasonable accommodations.

Student Wellness: As a student you may experience a range of issues that can cause barriers to learning or reduce your ability to participate in daily activities. These might include strained relationships, anxiety, high levels of stress, alcohol/drug problems, feeling down, health concerns, or unwanted sexual experiences. Counseling, Health Services, and Health Promotion are here to help with these or other issues you may experience. You learn can more about these programs and services by contacting:

Counseling Services:	120 Richmond Quad (North Campus), phone 716-645-2720 202 Michael Hall (South Campus), phone: 716-829-5800
Health Services:	Michael Hall (South Campus), phone: 716- 829-3316
Health Promotion:	114 Student Union (North Campus), phone: 716- 645-2837

If you find yourself struggling with course-related issues, or any other issues regardless of the reason, please do not hesitate to contact me so I can help you resolve the difficulty or direct you to resources that can.

Lecture Schedule

Dates	Week	Monday	Wednesday	Friday (Recitation)
		Nucleosynthesis & Isotopes		
1/27-1/31	1	A	B	Quiz 1
2/3-2/7	2	C	D	Problem Set 1
2/10-2/14	3	E	F	Problem Set 2
2/17-2/21	4	G	H	Problem Set 3
2/24-2/28	5	I	J	Quiz 2
3/2-3/6	6	K	L	Problem Set 4
3/9-3/13	7	M	N	**Exam I**
3/16-3/20	8	**Spring Break**		
		Equilibrium Thermodynamics		
3/23-3/27	9	O	P	Quiz 3
3/30-4/3	10	Q	R	Quiz 4
		Integrated Earth		
4/6-4/10	11	S	T	Problem Set 5
4/13-4/17	12	U	V	Quiz 5
4/20-4/24	13	W	X	Problem Set 6
4/27-5/1	14	Y	Z	Problem Set 7/Quiz 6
5/4-5/8	15	AA	BB	**Exam II**

A	Introduction & Nucleosynthesis I
B	Nucleosynthesis II
C	Radionuclide decay
D	K-Ar Dating
E	Radiocarbon Dating
F	Rb-Sr Dating & Isochrons
G	Fractionation
H	H-O Systematics Meteoric Water Line I
I	H-O Systematics Meteoric Water Line II
J	Marine Isotopes I
K	Marine Isotopes II
L	Stable Isotopes & Extinctions
M	Sampling & Stable Isotopes
N	Non-traditional Stable Isotopes

O	Law of Thermodynamics
P	Enthalpy, Entropy, & Gibb's Free Energy
Q	Reactions in P-T Space
R	Phase Diagrams with Changing Composition
S	Hydrologic Cycle
T	Chemical Weathering
U	Clay minerals & Carbonate Equilibria
V	Ocean Acidification
W	Contamination of the Natural Waters
X	Global Carbon Cycle
Y	Biomarkers
Z	Modern & Ancient Atmospheres
AA	History of Greenhouse Gases
BB	TBA