Spring 2023 | GEOL 1000 | Mineralogy

Professor: Ryan Kerrigan
Office: Krebs 227A
Office Hours: Thurs. 9:00-12:00 AM or by appointment
E-mail: kerrigan@pitt.edu
Office Phone: (814) 269-2942
Class time: Tuesday and Thursday 11:00-12:20
Class Room: Krebs B52
Lab time: Tuesday 2:00-4:50 PM
Lab Room: Krebs B50

Welcome to Mineralogy!

COURSE DESCRIPTION:

Basic mineralogy for geology majors and materials scientists. The principles of morphologic crystallography, crystal chemistry, and determinative mineralogy. Application of the principles of physical, chemical, structural, and determinative mineralogy to understand the genesis and uses of minerals and ores. Laboratory work includes the identification of minerals by various characterization methods including physical and spectroscopic methods. *Prereq: GEOL 0200 Geodynamics*

GOALS

- The primary purpose of this class is to help you conceptualize the principles of mineralogy, the study of the physics and chemistry of minerals. By the end of the course, you should be able to:
  - Be able to determine the diagnostic properties of minerals
  - Understand the physical and chemical attributes that determine mineral properties
  - Be able to interpret chemical data in mineral analysis
  - Be able to visualize and evaluate crystallographic and mineral structure data

Required Textbook:

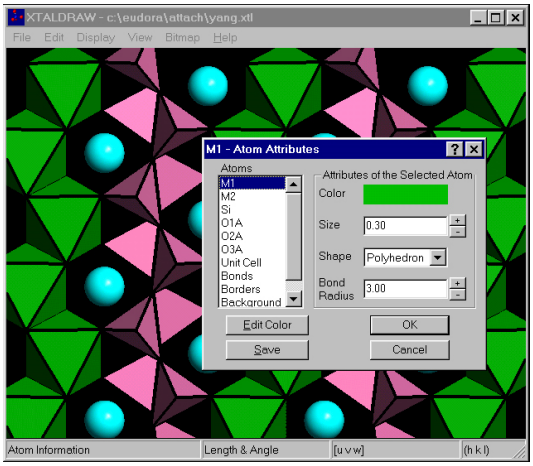
The Manual of Mineral Science by Cornelis Klein and Barbara Dutrow, 23rd edition, 2007, Wiley, ISBN-13: 978-0471721574, ISBN-10: 0471721573 (~$45 new paperback on Amazon). The textbook will also be available on Reserve at the library.

Additional resources:

The book comes with a CD that looks pretty helpful (you need Quicktime to run it). It will be a useful tool when study and I may involve it in some homework assignments.

We also will be using several types of software to analyze mineral structures. Robert Downs at University of Arizona has written several free programs that are powerful tools for this, and they are free! We will definitely use XtalDraw and I am trying to write exercises using the others.

Download Here:
http://www.geo.arizona.edu/xtal/group/software.htm



Other required materials:

Hand Lenses are available at the bookstore.

I recommend a 10X Triplet Hand Lens, those are good quality without getting crazy expensive. Here is a guide to hand lenses that is helpful: https://extension.psu.edu/a-brief-guide-to-hand-lenses

Evaluation of the Course

Exercises and other course material will be included in classes that are not part of the reading. It will be hard to "make up" missed classes. Readings and assignments are designed to give more detail on many topics than time allows for in class presentation. These additional assignments are an important part of the course and do not just reiterate lecture material. Some topics in the reading and assignments will not necessarily be covered in class but will appear on exams. Your final grade will be calculated as follows:

36% **Lecture Exams,** which is subdivided into three parts:
- 12% Exam I
- 12% Exam II
- 12% Final Examination (Tuesday, April 25th, 10:30 AM– 12:30 PM).

25% **Laboratory Exams,** which is subdivided into three parts:
- 10% Crystallography and Chemistry Exam
- 5% Mineral Quizzes
- 10% Mineral Exam

15% **Laboratory Exercises**

15% **Problem Sets**

9% **Final Project**

EXAMS

The best way to study for the exams will be discussed in class. All students are expected to take exams at the scheduled time unless they have a medical excuse signed by the Assistant Vice President for Academic Affairs, Dr. Steve Kilpatrick. **I must be notified prior to** any exam being missed in order for a makeup to be offered. The final exam is scheduled for TuesdayWednesday, December 15th at 10:30 AM. Please do not ask for extra credit or extra assignments to get extra credit. The answer is no.

PROBLEM SETS:

Problem sets will be handed out and students will have one week to complete them. There will be at least five problem sets due throughout the semester that will focus on current material as well as preparing you for upcoming material. Problem set due dates will be clearly stated on the top of the first page of the assignment but the due dates are also listed on the Course Schedule. Material handed in late will be deducted 10% for each day it is late, this includes weekend days.

LABS:

Labs are designed such that a student who is current with the class material and focuses should be able to complete the lab in the time allotted. However, some labs will at times be more difficult and require work outside of class time. Lab exercises will the first half of the semester will focus on crystallography and mineral chemistry considerations, whereas the second half of the semester will focus on descriptive mineralogy of major rock forming minerals. Lab topics will parallel those covered in concurrent lectures as closely as possible, but there may not always be a perfect overlap. At times, materials will be made available for use. Out of courtesy to others, please do not remove any materials from the lab!

Use all of the resources at your disposal, including your wits, the internet, each other (when acceptable), as well as the instructor. You are responsible for turning in *your own* work. Working with other students is encouraged, however, blatantly copying another student's work is unacceptable.

Please take care in preparing lab reports, since your grade will in part depend on the presentation of your reports. Write clearly, draw clearly and carefully what you see, and annotate captions with strings of words that make sense. If you feel your handwriting will be a hindrance to the professionalism of your reports, **type**. Please, thoroughly read the questions posed so that you answer all that is being asked of you. Labs are due at the start of lab the following week after they are assigned, unless stated otherwise. Late assignments will lose 10% each day of its tardiness.

FINAL PROJECT:

You will be given an unknown mineral and will run a variety of test to determine the physical and chemical properties of the mineral. Throughout the semester you will learn various skills that will allow you to determine the properties and process the data. Field trip #2 to the NFCF at Pitt's Main Campus will require that you to prepare your sample for analyses and during that field trip you will see the instruments and learn about the data sets obtained. Your final report should include (but not be limited to) the following: positive identification of your unknown mineral with data to support your conclusion; a history of the mineral; uses and occurrences (geologically and geographically); a discussion of the structure and chemistry and how those attributes contribute to the physical characteristics of your mineral. Your final product should include an 8-10 page paper on your mineral and an 8 minute presentation to be given in the last week of class. More information will be provided as the semester progresses.

EXPECTATIONS:

The study of mineralogy is both challenging and fun. You will have the chance to learn in a hands-on way in class and lab, and I hope you find this class both enjoyable and challenging. A few things to keep in mind will maximize your potential success in this course:

Attendance: I do not take attendance, but you are expected to attend each class and lab. Much of the learning takes place in the classroom and laboratory, and often cannot be made up or reproduced, so be in class. Attendance is also a great predictor of grades! It is your responsibility if you miss a class and you will be held accountable for any reading assignments, exams, and any deadlines or changes announced. If you do miss a class, see your classmates to make up for what you have missed. Please contact me if you have any further questions or a scheduled absence.

Prerequisites: I assume a basic understanding of physical and historical geology, including an elementary knowledge of chemistry. If you have had Chemistry I and II prior to attempting mineralogy, you will be better off.

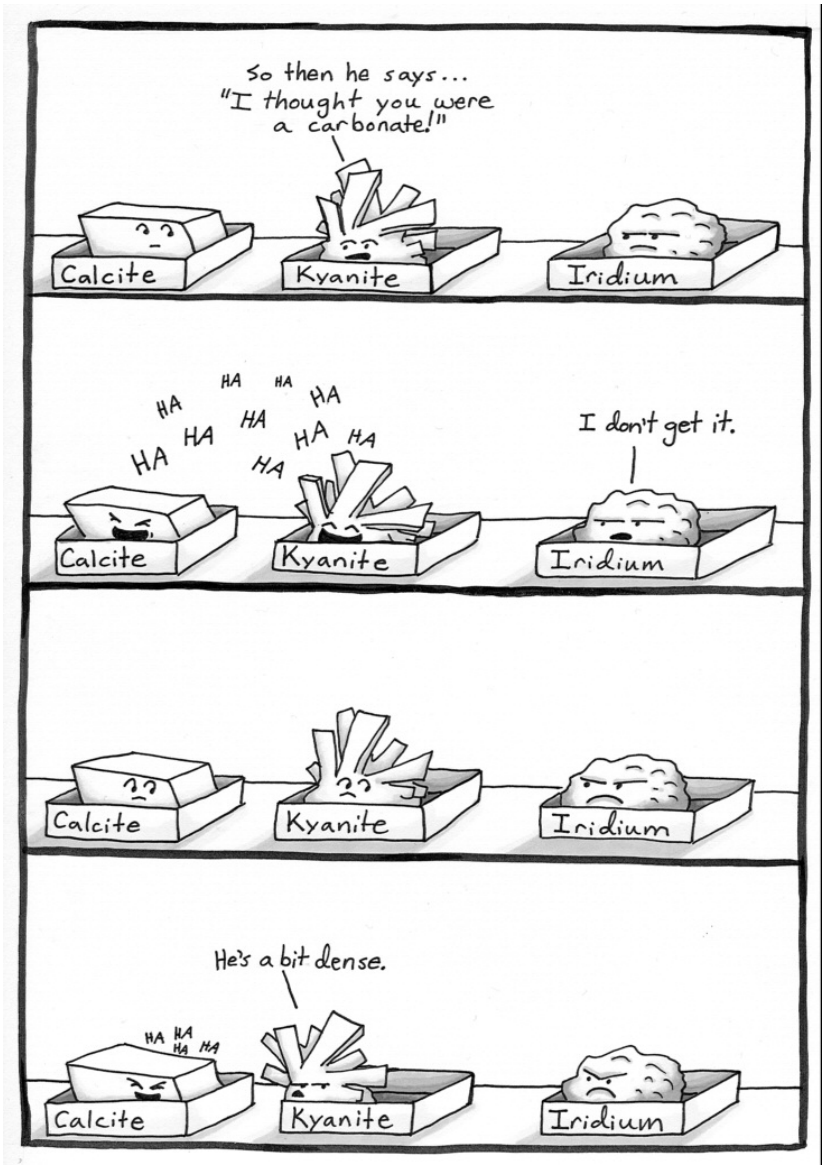
Assignments / workload: It is also essential that you read the assigned pages prior to class and participate in class. As with your other courses, you should expect to spend about 2-3 hours outside of class for each credit hour. So for this class, expect to spend a minimum of 9 hours *outside* of class each week reading, working on the problem sets, exercises, labs, and mineral practice. **Late assignments will lose 10% for each day they are late** except under extremely unusual circumstance (illness, emergency, etc.). If you know you are going to be absent, however, please contact me as soon as possible to make arrangements.

Accommodations: If you have a condition for which you either are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Health and Counseling Services, G-10 Student Union, 814-269-7119, as early as possible in the term. The Office of Health and Counseling Services can verify your disability and determine reasonable accommodations for this course.

Ask for help: Please seek help if you are confused or in need of clarification. Please visit me at office hours.

Academic integrity: UPJ values the academic integrity of its students and faculty. It is your responsibility to familiarize yourself with the university's policy on academic integrity (http://www.upj.pitt.edu/globalassets/documents/academics/upj-academics-integrityguidelines.pdf). Violations of academic integrity will be reported to and judged by the academic integrity committee. If you are found responsible for violating the policy, penalties may include a failing grade as well as possible probation, suspension, or expulsion, depending on the seriousness and circumstances of the violation and your history of past violations.

Electronics: Electronics are PROHIBITED in class; no computers, ipads, phones, music players, beepers, pagers, watches, etc. Please turn them off and put them away, please do not use them during class.


So then he says...
"I thought you were a carbonate!"
Calcite
Kyanite
Iridium
HA
HA
HA
HA
HA
HA
HA
HA
HA
I don't get it.
Calcite
Kyanite
Iridium
Calcite
Kyanite
Iridium
He's a bit dense.
HA HA HA HA
Calcite
Kyanite
Iridium

Schedule of Events			
Week	**Tuesday (Lecture)**	**Tuesday (Lab)**	**Thursday (Lec)**
1	January 10, 2023 Mineral Chemistry pgs. 1-17, 90-108	January 10, 2023 Mineral Properties: Part I pgs. 19-36	January 12, 2023 Mineral Groups and Vocab pgs. 434-481
2	January 17, 2023 Bonding pgs. 37-64	January 17, 2023 Mineral Properties: Part II pgs. 96-108, 309-10, 321-27	January 19, 2023 **Problem Set #1 Due** Pauling's Rules pgs. 66-89
3	January 24, 2023 Symmetry pgs. 109-129	January 24, 2023 Chemical Compositions structures	January 26, 2023 **Problem Set #2 Due** Point Groups pgs. 129-142, 182-208
4	January 31, 2023 Symmetry & Miller Indices pgs. 307-321	January 31, 2023 Crystal Structures	February 2, 2023 **Problem Set #3 & #4 Due** X-Ray Diffraction pgs. 323-330
5	February 7, 2023 Electron Beam Analyses	February 7, 2023 Symmetry, Crystal Form	February 9, 2023 **EXAM I**
6	February 14, 2023 Native Elements pgs. 331-336, 342-351	February 14, 2023 X-ray Diffraction pgs. 307-321	February 16, 2023 **Problem Set #5 Due** Native Elements
7	February 21, 2023 Oxides pgs. 368-373, 375-390	February 21, 2023 **Smithsonian Field Trip**	February 23, 2023 **Problem Set #6 Due** Oxides
8	February 28, 2023 Oxides	February 28, 2023 **LAB EXAM I**	March 2, 2023 **Problem Set #7 Due** Hydroxides pgs. 373-375

Schedule of Events			
Week	**Tuesday (Lecture)**	**Wednesday (Lab)**	**Thursday (Lec)**
9	March 7, 2023 **SPRING BREAK**	March 7, 2023 **SPRING BREAK**	March 9, 2023 **SPRING BREAK**
10	March 14, 2023 Halides pgs. 390-398	March 14, 2023 Native elements, Oxides, Hydroxides, & Halides	March 16, 2023 **Problem Set #8 & #9 Due** Nesosilicates pgs. 434-441, 483-498
11	March 21, 2023 Nesosilicates	March 21, 2023 Neso, Soro, & Cyclosilicates	March 23, 2023 **EXAM II**
12	March 28, 2023 Sorosilicates pgs. 441-442, 498-502	March 28, 2023 Ino, Phyllo, & Tectosilicates	March 30, 2023 **Problem Set #10 Due** Cyclosilicates pgs. 442-445, 502-504
13	April 4, 2023 Inosilicates pgs. 446-456, 505-518	April 4, 2023 Ates & Sulfides	April 6, 2023 **Problem Set #11 Due** Inosilicates
14	April 11, 2023 Inosilicates	April 11, 2023 **Mineral Project Presentations**	April 13, 2023 Phyllosilicates pgs. 456-467, 519-533
15	April 18, 2023 **Exam Questions Due** Tectosilicates pgs. 467-482, 534-552	April 18, 2023 **MINERAL EXAM**	April 20, 2023 **Problem Set #12 & #13 Due** Ates & Ides pgs. 337-340; 351-366,399-433
16	**Tuesday** **April 25th** 10:30 AM - 12:30 AM **FINAL EXAM**		

*This schedule will be fluid at times to adjust for the pace and comprehension of the class.