

Overview:

This course introduces the physical and chemical properties of minerals within their context as the fundamental building blocks of rocks. Particular emphasis will be given to learning the association of minerals with the rock types they typically occur in, as well as a basic introduction to the petrologic processes that form them. Skills to be learned include mineral observation and identification techniques in hand samples and thin section, as well as an introduction to quantitative analytical techniques such as SEM and XRD, and how to use the data produced by each technique.

Instructors:

Prof. Kari Cooper, kmcooper@ucdavis.edu, Room 3127 Earth & Physical Sciences Building

Lecture TA: Emily Sonnenberg, esonnenberg@ucdavis.edu

Lab TA's: Paige Cary, pacary@ucdavis.edu; Anjelica Guerrier, aaguerrier@ucdavis.edu

Office Hours:

Cooper: TBA

Sonnenberg: TBA

Cary: TBA

Guerrier: TBA

Meeting Times/Locations:

Lectures:

MWF: 10:00-10:50 am, EPS 1348

Lab sections:

A01: M 4:10-7:00 pm, EPS 1314

A02: W 1:10-4:00 pm, EPS 1314

Important Dates:

1. Labs begin: Mon/Weds, **September 27-29** (in EPS 1314)
2. Lab midterm: Mon/Weds **October 18-20**, during your regularly scheduled lab period
3. Lecture midterm: Wednesday, **October 27**, during class period
4. Thanksgiving Day Holiday: Friday **Nov. 26**: no class (also note that there will be no labs this week).
5. Final exam: Friday, **December 10, 8-10 am**

Textbook:

Required text:

Earth Materials: Introduction to Mineralogy and Petrology, Klein & Philpotts, Cambridge University Press. Any edition is ok (1st Edition (2013), 2nd edition (2016)).

Optional/recommended:

An Introduction to the Rock-forming Minerals, 3rd Edition, Deere, Howie, and Zussman, Mineralogical Society, London, 2013.

Introduction to Optical Mineralogy, Nesse, W.D., Oxford University Press, 2004.

Atlas of Rock-forming Minerals in Thin Section, Mackenzie and Guilford, Wiley & Sons, 1980

Course format

Class Lectures:

This year lectures will be in person. I will be using an active learning model where students read and/or watch pre-recorded content prior to lecture times in order to get basic concepts, and then much of the time in live lectures will be devoted to questions from students about the material, additional explanations, and sometimes practicing applying the concepts with in-class assignments and small group work. **This means that it is very important that you come to class having finished the pre-assigned readings/videos, and be prepared to participate in class!** Education research shows that active learning strategies increase student learning and retention of material (Deslauriers, L., Schelew, E. & Wieman, C., 2011, *Science* 332, 862- 864) and has a particularly beneficial effect for underrepresented groups (Theobald et al. 2020, *Proc. Nat. Acad. Sci.* 117, 6476–6483). Plus, it's a lot more interesting and fun than just being lectured at!

Labs:

The laboratory sessions meet once a week, in person. **Attendance is mandatory:** these sessions are an integral part of this course and you are required to attend. The previous lab exercise is due at the beginning of the first session of a new lab exercise. Because of covid-19 restrictions and some past problems with microscopes, **there will be no access to microscopes or samples outside of the scheduled labs and lab TA office hours.** As with problem sets, **no credit will be given for labs turned in late.** Late labs, however, will be corrected by your TAs, if time permits.

Hand Lens:

A 10x hand lens is required for this course. If you are a geology major and do not own one, now is the time to buy one. The bookstore may carry them or you can get them through other sources such as Amazon.com. If you have any questions about the type or quality of hand lens necessary, please talk to one of the TAs.

Grading:

Grading will be based 60% on lecture material and 40% on lab material, as follows:

Quizzes, in-class assignments, and participation:	10%
Problem sets:	15%
Lecture Midterm:	15%
Lecture Final Exam:	20%
Lab exercises:	30%
Lab exams:	10%

Quizzes, in-class assignments, and participation:

There will be a short quiz due before most of the lectures, based on reading and/or videos assigned for the day. In addition, there will be short in-class assignments associated with

some/most class meetings. These assignments must be submitted during class and there is no make-up for them. The points for participation will be tracked partly through the in-class assignments and partly through how actively you are participating during discussions.

Problem sets:

There will be six problem sets due throughout the quarter. They will usually be due one week after being posted. You are welcome to turn in your problem set early; **however, no credit will be given for problem sets turned in late.** Solution keys will not be posted, though every effort will be made to grade and hand them back before the next problem set is assigned. I highly recommend you take advantage of office hours to review the problem sets after they have been graded. These will build on lectures and reading by giving you some experience working through problems and calculations related to the course material, as well as having some questions that are similar to exam questions.

Lecture exams:

You must take the exams at the regularly scheduled time. The only exceptions to this policy are for *truly exceptional* circumstances such as a serious illness that prevents you from taking the exam (must be documented by a doctor) or a family emergency. The burden is on you to convince me that the circumstances are truly exceptional – things like forgetting to set your alarm, forgetting the time of the exam, or travel to attend a family event do *not* constitute an emergency. The final exam for the course is scheduled for Friday Dec.10 at 8:00-10:00 am.

Lab exams:

Lab exams will be given during your regularly lab period for the week, and will be held in the lab room. They will assess your practical skills and information related to the lab exercises.

COVID-19 Safety Protocols

We will be following the protocols and guidance on safety on the UCD Campus Ready site (<https://campusready.ucdavis.edu/>). Masking in class and in labs will be strictly enforced. We also will be checking daily symptom surveys in order to ensure that everyone is complying with the campus regulations on vaccinations (or exceptions) and testing. No one will be allowed into the classroom without an approved daily symptom survey. You must also email the survey results each day to gel-survey@ucdavis.edu to facilitate contact tracing in the building.

Accessibility and accommodations:

If you have concerns about accessibility or need special accommodations for exams or lectures, first contact the UC Davis Student Disability Center. If they determine that special accommodations are warranted, I will work with you to find a solution. Accommodations must be put in place *before* the lab sections or exams, and it is your responsibility to start the process early enough to allow enough time for this to happen.

Academic honesty:

Academic misconduct such as cheating or plagiarism will be dealt with in accord with the Code of Academic Conduct. You must review this document before the course and confirm that you have reviewed it online (you will be prompted to do so by email and on MyUCDavis). An updated version can be found at <http://sja.ucdavis.edu/files/cac.pdf>. You must also confirm your participation in this course by following this link: participate.ucdavis.edu.

Academic Senate policy *requires* instructors to report any suspected cases of cheating or plagiarism to Student Judicial Affairs.

Schedule

GEL 60 2021: Earth and Planetary Materials						
Week	day	date	Lecture Topics	Lecture Reading	Lab Topics	Problem Sets
0	Wednesday	9/22/21	Introduction to Earth Materials course	Ch. 1-3, K&P	No lab	
	Friday	9/24/21	Mineral prop's and ID continued	Ch. 1-3, K&P		Problem set 1 posted
1	Monday	9/27/21	Basics of crystallography	Ch. 4-5, K&P	Hand sample ID	
	Wednesday	9/29/21	Crystallography 2	Ch. 4-5, K&P		
	Friday	10/1/21	Wrap up crystallography	Ch. 6, K&P		Problem set 1 due; Problem set 2 posted
2	Monday	10/4/21	Optical microscopy 1	Ch. 6, K&P	Optical mineralogy 1	
	Wednesday	10/6/21	Optical microscopy 2	Ch. 6, K&P		
	Friday	10/8/21	optical 3	Ch. 6, K&P		Problem set 2 due
3	Monday	10/11/21	optical wrap-up and summary	Ch. 7, K&P	Optical 2	
	Wednesday	10/13/21	Igneous rock forming minerals	Ch. 7, K&P		
	Friday	10/15/21	More on igneous minerals	Ch. 7, K&P		Problem set 3 posted
4	Monday	10/18/21	Formation of igneous rocks, phase diagrams	Ch. 9, K&P	lab midterm	
	Wednesday	10/20/21	igneous rock occurrence and classification	Ch. 9-10, K&P		
	Friday	10/22/21	Igneous rocks and their tectonic associations	Ch. 9-10, K&P		Problem set 3 due
5	Monday	10/25/21	midterm review		Igneous minerals	
	Wednesday	10/27/21	lecture midterm			
	Friday	10/29/21	Metamorphic rock-forming minerals; prograde vs. retrograde index minerals	Ch 14-15 K&P		
6	Monday	11/1/21	Metamorphic grade and facies	Ch 14-15 K&P	Metamorphic Minerals 1	Problem set 4 posted
	Wednesday	11/3/21	intro to thermodynamics	Ch 14-15 K&P		
	Friday	11/5/21	thermodynamics, cont.	Ch 14-15 K&P		
7	Monday	11/8/21	Tectonic association of metamorphic rocks	none	Metamorphic Minerals 2	
	Wednesday	11/10/21	Sedimentary rock-forming minerals	Ch 11-12 K&P		
	Friday	11/12/21	Sedimentary rock formation and processes, classification and association	Ch 12-13 K&P		Problem set 5 posted
8	Monday	11/15/21	Ore minerals and economic geology	Ch 16, K&P	sedimentary minerals	
	Wednesday	11/17/21	Ore minerals and economic geology	Ch 16, K&P		
	Friday	11/19/21	reading exercise			
9	Monday	11/22/21	reading exercise	TBA	no lab	Problem set 5 due
	Wednesday	11/24/21	Analytical methods: intro to X-ray diffraction	TBA		
	Friday	11/26/21	Thanksgiving holiday			
10	Monday	11/29/21	XRD continued	TBA	lab final	
	Wednesday	12/1/21	intro to electron microbeam methods	TBA		
	Friday	12/3/21	Review for final exam			Problem set 6 due
Finals week	Friday	12/10/21	Final exam. Scheduled time is 8-10 am.			