

GEOL 201 - Mineralogy & Optical Crystallography

Instructor - F. Zeb Page
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Office Hours - M 11-12
T 10 - 11
F 1-2

also drop in & by appointment

Text - Introduction to Mineralogy by William D. Nesse (Oxford Univ. Press, 2000)

Recommended text - An Introduction to the Rock-Forming Minerals by Deer, Howie & Zussman (Pearson, 1992)

Lecture MWF 10:00 - 10:50, Carnegie 412

Lab W 1:30 - 4:20, Carnegie 412

Course Goals - The solid part of our planet is composed almost entirely of minerals. The physical and chemical properties of these minerals play major roles in shaping Earth's processes from the very small to the very large scales. In this course we will study the major mineral groups that make up our planet (and much of the solar system) from both physical and chemical perspectives. In particular, we will discuss crystal symmetry and structure as well as stoichiometry and the chemistry and thermodynamics of minerals. Finally, we will learn about and use analytical methods used to study and characterize minerals from polarized-light optical microscopy to methods that make use of X-ray and electron beams.

Evaluation - Your grade will be based on the following components:

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|------------------------------------|-----|
| Labs and homework | 50% |
| Mineral drawer book & conversation | 20% |
| Take-home exams (3@10%) | 30% |

Assignments - Please complete the reading assignments before the class in which we discuss them. Labs are due at the following lab period, homework assignments may vary in length. Failure to turn work in on time puts you at risk of losing points...asking for an extension before the due date can protect you from this.

Tests - Tests in this class are meant to be both an evaluation and a learning experience. Because this is difficult to do in a one-hour period, they will be take-home, open-book exams over a 3-5 day period.

Mineral Drawer - Not many geologists go on to be mineralogists or petrologists, but virtually all need to know how to identify common and scientifically useful minerals, as well as how to go about identifying a mineral and constraining its chemical composition. You will learn how to do these things in lecture and lab, and you will practice these skills on a suite of minerals throughout the semester. Working independently or in small groups you will collect data on the minerals in the drawer, and at the end of the semester we will have a one-on-one conversation about your findings.

Honor Code - Oberlin students are bound by the honor code, details of which can be found at <http://www.oberlin.edu/students/links-life/honorcode.html>. For the purposes of this class, exams should be completed individually unless otherwise indicated at the time. I encourage you to collaborate with your colleagues on lab and homework assignments as well as the mineral drawer project as long as each one of you works on all aspects of the assignment and your answers are in your own words. Please write and sign the honor pledge on each assignment turned in for evaluation.

Lab Fees - The Geology Department requests, nay, requires each student in lab courses to pay a fee of \$10 to help defray lab costs. Please pay Retha Ball (Carnegie 417) by cash or check.

Services for students with disabilities - If you have a documented disability and will require accommodations in this course, please see me or Jane Boomer (Services for Students with Disabilities, Peters Hall G27, x5-8467) in the first two weeks of the semester to develop a plan to address your needs.

Field Trip - We will be taking a four-day trip (Thur-Sun) probably to the Adirondacks. Missing classes can be awkward, but because much of geology is a field-based science and because good mineral hunting is difficult in NE Ohio, we will need 4 days away. I believe that this is a vital part of any geologist's education, and am willing to write or call other professors on your behalf to ask for accommodation. If you absolutely cannot attend the trip because a prior commitment that cannot be rearranged, you can complete a research paper in lieu of the field experience.

Class schedule (subject to change as necessary)

| Date | Day | Topic | Nesse | Lab (Wed PM) |
|------|-----|---|---------|-------------------------------|
| 9/3 | W | intro/tour | 3-5 | classification |
| 9/5 | F | origin and composition of the earth | 39-46 | |
| 9/8 | M | crystal chemistry & bonding | 46-56 | "Let's get packed" |
| 9/10 | W | crystal structure & packing | 57-65 | |
| 9/12 | F | polymorphism, classification & solid solution | 66-73 | |
| 9/15 | M | symmetry elements, lattices | 6-13 | crystal morphology |
| 9/17 | W | crystal systems, forms, Miller indices | 13-38 | |
| 9/19 | F | physical properties of minerals | 97-113 | |
| 9/22 | M | optical properties of matter | 114-118 | isotropic minerals 151-156 |
| 9/24 | W | isotropic minerals | 118-122 | |
| 9/26 | F | native elements, 1st exam due | 397-404 | |

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| 9/29 | M | uniaxial minerals | 122-127 | unaxial minerals 137-140 |
| 10/1 | W | uniaxial minerals | 127-131 | |
| 10/3 | F | sulfides + | 378-396 | |
| 10/6 | M | biaxial minerals | 133 | biaxial minerals |
| 10/8 | W | biaxial minerals | 143-151 | |
| 10/10 | F | oxides, | 356-369 | |
| 10/13 | M | X-ray crystallography | 160-168 | XRD I |
| 10/15 | W | X-ray crystallography/exam questions | | |
| 10/17 | F | hydroxides & halides | 370-377 | |
| 10/20-24 | | Fall Break | | |
| 10/27 | M | Reactions, nucleation, growth | 74-81 | XRD II |
| 10/29 | W | phase diagrams & crystal zoning | 81-84 | |
| 10/31 | F | carbonates | 326-340 | |
| 11/3 | M | chemical analysis of minerals | 169-174 | SEM/EDS I |
| 11/5 | W | SEM/EDS and X-ray spectroscopy | handout | |
| 11/7 | F | other -ates | 340-355 | |
| 11/10 | M | more phase diagrams & thermo | handout | SEM/EDS II |
| 11/12 | W | still more phase diagrams & thermo | handout | |
| 11/14 | F | silicates:most of the earth, 2nd exam due | 180-200 | |
| 11/17 | M | framework silicates: the silica group | 201-208 | crystal chemistry of tryptophan |
| 11/19 | W | feldspars: just about the whole crust | 208-220 | |
| 11/21 | F | feldspathoids: not enough Si to go around | 225-234 | |
| 11/24 | M | sheet silicates: build 'em up | 235-243 | Independent work on mineral drawers |
| 11/26 | W | sheet silicates: build 'em up higher! | 244-260 | |
| 11/28 | F | Thanksgiving break | | |
| 12/1 | M | pyroxenes: just a link in the chain | 261-276 | Independent work on mineral drawers |
| 12/3 | W | amphiboles: don't breath them in | 277-289 | |
| 12/5 | F | rare disilicates and pretty ring silicates | 291-305 | |
| 12/8 | M | orthosilicates: the mantle | 306 | Mineral drawer conversations |
| 12/10 | W | orthosilicates: indices of metamorphism | 310,314-323 | |
| 12/12 | F | orthosilicates: geochronology | 312 | |
| 12/15-12/19 | | American Geophysical Union meeting, Zeb in San Francisco | | |
| 12/18 | Th | final exam period, 3rd exam must be emailed to me by 4PM | | |