

Earth Sciences 110B/110M: Earth as a Chemical System
Winter 2018
TTh 9:50 - 11:25 am, Nat Sci Annex 101

Instructor: Elise Knittle, Earth & Marine Science C468, email: eknittle@ucsc.edu
Office Hours: Monday: 11:00 am -1 pm and by appointment

Class website: <https://canvas.ucsc.edu>

TA's: Kellen Martin email: knmartin@ucsc.edu
Andrea Rhode email: arhode@ucsc.edu

Text: I will post readings on the website to augment the lecture material. For lab, I will post relevant reading material on the website and there will also be standard mineralogy textbooks available during lab for reference which you can borrow and share.

Basis for Evaluation: Your grade/evaluations in this course will be based on the **midterm exam** (30%), **final exam** (40%) and **quizzes** (30%).

Everyone enrolled in this class should also enroll in
EART 110 M: Earth as a Chemical System Lab
Earth and Marine Sciences D236

There are five lab sections for this course:

- Tu 2-5 pm
- Tu 6-9 pm
- Wed 12:30-3:30 pm
- Thurs 4-7 pm
- Friday 9 am-12 pm

Basis for Evaluation in 110M: In this course you will be evaluated on your successful completion of the lab exercises, occasional quizzes and on a 3-hour Lab Practical Exam.

BUT NOTE: Failure to pass the Lab Practical will result in failure of 110M.

WEEKLY SCHEDULE
ES 110B and M
Winter 2018

WEEK 1 (Jan 9 and 11)

Lecture Topics: Introduction to crystallography and mineralogy. Crystallography topics: bonding, unit cells, organization of atoms into crystal classes, Bravais lattices
Lab: NO LAB

WEEK 2 (Jan 16 and 18)

Lecture Topics: Crystallography continued: Miller indices, x-ray diffraction, identifying minerals by xrd pattern etc. Overview of mineral groups, basic review of chemical principles relevant to understanding mineral structures
Lab 1: Crystallography: Unit cells, Bravais lattices, Miller indices

WEEK 3 (Jan 23 and 25)

Lecture topics: Crystal chemistry, phase diagrams and their use in understanding rock formation. The crystallization of the lunar magma ocean as an example of the principles behind Bowen's reactions series and binary phase diagrams.
Lab 2: Crystallography: X-ray diffraction

IN CLASS 10-minute QUIZ Tuesday Jan 23rd

WEEK 4 (Jan 30 and Feb 1)

Lecture topics: Mineralogy of rock-forming silicate minerals, the rocks these minerals occur in and the processes that form those rocks...particular focus on the formation of basaltic and related rocks. Phase diagrams relevant to the formation of basalts – binary eutectic diagrams. Plotting minerals and rock data on ternary diagrams.
Lab: Systematic mineralogy: tektosilicates (SiO₂ polymorphs and feldspars) and plutonic rocks.

WEEK 5 (Feb 6 and 8)

Lecture topics: Mineralogy of rock-forming silicate minerals, continued. Phase diagrams with a solvus. Role of water in igneous processes. Hydrous phase diagrams and the effect of water on phase equilibria. Formation of the continental crust.
Lab: Systematic mineralogy: inosilicates (pyroxenes and amphiboles) and phyllosilicates (micas, clays, serpentines etc.) and related rocks.

IN CLASS 10-minute QUIZ Tuesday Feb. 6th

WEEK 6 (Feb 13 and 15)

TUESDAY FEBRUARY 13: Midterm Exam

Lecture topics: Formation of continental igneous rocks continued. A little bit on ultramafic rocks. Introduction of metamorphic processes, minerals and rocks.

Lab: Systematic mineralogy: nesosilicates (olivines, garnets, zircon etc.) and a selection of relevant rocks.

WEEK 7 (Feb 20 and 22)

Lecture topics: Mineralogy of rock-forming non-silicate minerals. The standard metamorphic facies and phase diagrams relevant to metamorphic rocks.

Lab : Systematic mineralogy: non-silicates: carbonates, native elements, sulfides and sulfosalts and relevant rocks.

WEEK 8 (Feb 27 and March 1)

Lecture topics: Mineralogy of rock-forming non-silicate minerals. Hydration of minerals, chemical weathering, metasomatism.

Lab: Non-silicates continued: oxides and hydroxides, borates, halides, sulfates and phosphates and relevant rocks

IN CLASS 10-minute QUIZ Tuesday Feb. 27th

WEEK 9 (March 6 and 8)

Lecture topics: Mineralogy of rock-forming non-silicate minerals: ore formation, carbon and sulfur geochemistry.

Lab: Catch-up and preparation for lab final.

IN CLASS 10-minute QUIZ Thursday, March 8th

WEEK 10 (March 13 and 15)

Lecture topics: Cycling of chemical elements on the Earth. The bulk chemistry and mineralogy of the Earth.

Lab: LAB FINAL IS Tues/Wed/Thurs/Fri March 13, 14, 15, or 16 DURING YOUR NORMAL LAB SECTION

FINAL EXAM IS THURSDAY MARCH 22, 2018 8-11 am

