

Earth and Planetary Materials
Spring 2013

This course will cover both fundamental principles and applications of mineralogy and petrology for understanding the composition of surface and subsurface materials on Earth and other planetary bodies. Students will learn the chemical structures of important mineral classes, and how mineral assemblages and micro-textures record the conditions of rock formation and alteration. A range of laboratory techniques for measuring mineralogy and petrology will be introduced.

Lectures:

MW 4:30-6:00 PM @ ES&T L1105

Instructors:

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Office hours: T 12:30-1:30, or by prior arrangement (email, please)

Texts:

(K) Klein, C. Manual of Mineral Science, 23rd Edition, John Wiley, 2008 (22nd Ed. OK)

(W) Winter, J.D. An Introduction to Igneous and Metamorphic Petrology

Course requirements:

Attendance and Participation: 20% (If you miss 6 classes, you will not pass)

Homework + Quizzes: 40% (~6 in total)

Exams (Midterm and Final Exam): 40% (20% each)

Late policy:

All material handed in late will be deducted 20% per day.

Topics to be covered (tentative)

Mineralogy

- Electronic structure and bonding in minerals, valence/formal charge of ions
- Principles of crystal chemistry
- Close-packed anion arrays (CCP and HCP)
- Simple ionic structures AX, AX₂; oxide minerals
- Native elements, sulfides
- Minerals of oxyanions: carbonates, sulfates, phosphates
- Classification of silicate minerals
- Symmetry: point symmetry, point groups
- Stereographic projection; crystallographic coordinate systems; planes, Miller indices; crystal forms
- Mineral surfaces/aqueous interactions: adsorption, substitution, precipitation
- Analytical techniques (optical, chemical, structural)

Petrology

- Phase diagrams: 1-component systems (SiO₂, H₂O)
- Phase diagrams: 2-component systems (solid solution, eutectic, peritectic)
- Phase diagrams: 3-component systems
- Classification of igneous rocks
- Bowen's reaction series; formation and identification of various igneous rocks
- Major and minor elements, normative mineralogy
- Trace elements
- Metamorphic processes and settings; classification and identification of metamorphic rocks
- Metamorphic facies; metamorphic reactions
- Low-temperature alteration assemblages; sedimentary rocks