

# GEO 416K

## Earth Materials

### Fall 2011

#### Course Syllabus

**Instructor:** James Gardner  
**Office:** JSB 4.108; 471-0953  
**Office Hours:** MTWTh 1-2 PM, or by appointment  
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**Course Overview:** This course is intended as an introduction to minerals, igneous and metamorphic rocks, and their associated rocks. We will also learn about the techniques to study them. For many of you, this will be the only time you get to see what constitutes most of the Earth. For others, this will be the springboard to a more in-depth study of the petrology and petrography of igneous and metamorphic rocks in GEO 426P. There are two components to the course: a one-hour lecture on MWF, and 2 two-hour laboratory sessions per week.

**Course Summary:** Much of our understanding of the Earth and its evolution through time comes from identifying and mapping rocks throughout the world. Different rock types and minerals play crucial roles in a multitude of basic and applied sciences, including the material sciences, building construction, and superconductivity, to name just a few. The purpose of this course is to give all of you a hands-on opportunity to learn about rocks, mainly igneous and metamorphic, and their mineral constituents. You will be exposed to some basic techniques for identifying minerals in hand sample and using optical microscopy.

**Required Text:** Manual of Mineral Science by C. Klein and B. Dutrow. This required text will be used extensively in both lectures and your lab; you should bring it everyday to both. Other readings will be assigned throughout the course, and those books will be on reserve in the Geology Library. The more important graphics that I will show in lecture are available on-line as pdf files on Blackboard, under assignments. The title of the lecture matches that listed on the syllabus below. You should have a copy of the pertinent graphs and images by the beginning of the class.

**Laboratory Information:** Laboratory is held in EPS 2.102. You will receive a separate syllabus for your lab section in the first lab. There will be a mid-term and final examination in the laboratory, covering laboratory material. You will need a hand lens (10x) for many laboratories, and so you should purchase one. Your first laboratory will be either Monday (8/29/11) or Tuesday (9/30/11), depending on your lab section.

**Grades:** Your final course grade will be based on the combined results of the lecture and laboratory portions of your class in the approximate proportions: 3 class exams (39%), final exam (13%), and laboratory score (48%). **THERE IS NO GRADE CURVE IN THIS COURSE.** Plus/minus grades will be assigned for the final grade.

*Class exams:* There will be three full-period class examinations during the course, which are listed on the class schedule. No books or class notes are permitted. Attendance to these exams is required, and a missed exam will be counted as a zero, unless a written doctor's excuse is provided. If an acceptable excuse is provided, a make-up exam will be given. Anyone caught cheating on the exams will receive a zero.

*Final Examination:* A final examination will be given during the time scheduled by the registrar (December 7, 9 AM – 12 PM). It will cover the last approximately quarter of the class, following the third class exam. No books or class notes will be permitted. Attendance to this exam is required, and a missed exam will be counted as a zero, unless a written doctor's excuse is provided. If an acceptable excuse is provided, a make-up final will be given. Anyone caught cheating on the final will receive a zero.

*Laboratory Score:* This portion of your grade is based on your laboratory exercises, quizzes, and examinations, as determined by your laboratory instructor. *The laboratory is a required part of the course, and completion and receiving a passing grade is required to pass the course.* See your laboratory syllabus for details and dates.

**Prerequisites:** There are several prerequisites that you must have fulfilled to be in this class. Please confirm that you have fulfilled them:

- Grade of C or better in GEO 401 or GEO 303 or GEO 312K
- Grade of C or better in CH 301
- Grade of C or better in *OR* concurrent registration for CH 302

**Special Needs:** The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. To determine if you qualify, please contact the Dean of Students at 471-6259. If they certify your needs, I will work with you to make appropriate arrangements.

Date	Lecture	MWF 10-11	Lab	Date	Laboratory Topic
8/24	Introduction/Overview				No labs this week
8/26	Cystallography				
8/29	Point Symmetry		1	29, 30	Introductory Lab
8/31	Miller Indexes		2	31, 1	Symmetry of Minerals
9/2	Crystal Forms				
9/5	Labor Day Holiday			5,6	No lab Monday or Tuesday
9/7	Chemical bonds and Coordination		3	7,8	Crystal axes
9/9	Bond strength and silicate structures				
9/12	Mineral Classes		4	12,13	Crystal Faces and Forms
9/14	Substitutions, Defects, and Twinning		5	14,15	Identification of Real Minerals
9/16	Physical Properties				
9/19	Petrographic Microscopes		6	19,20	X-ray Diffraction
9/21	<b>CLASS EXAM</b>		7	21,22	Introduction to Microscopy
9/23	Optical Interferences				
9/26	Uniaxial Indicatrix I		8	26,27	Optical Properties I
9/28	Uniaxial Indicatrix II		9	28,29	Optical Properties II
9/30	Biaxial Indicatrix I				
10/3	Biaxial Indicatrix II		10	3,4	Optical Properties III
10/5	Biaxial Indicatrix III		11	5,6	Optical Properties IV
10/7	Extinction and Pleochroism				
10/10	Crystal Formation		12	10,11	Mineral Formulas
10/12	Earth's Mantle and Crust		13	12,13	Optical Properties V
10/14	<b>CLASS EXAM</b>				
10/17	Mantle melting and Tectonics			17,18	<b>LABORATORY MIDTERM</b>
10/19	Mid-ocean Ridges		14	19,20	Identifying Igneous Rocks
10/21	Crystallization I				
10/24	Crystallization II		15	24,25	Mantle Melting
10/26	Igneous Textures		16	26,27	Plutonic Igneous Rocks
10/28	Magmatic Intrusions				
10/31	Volcanic Eruptions		17	31,1	Extrusive Igneous Rocks
11/2	Interpreting Magma Dynamics		18	2,3	Pyroclastic Rocks
11/4	Volcanoes and Their Hazards				
11/7	Introduction to Metamorphic Rocks		19	7,8	Metamorphic minerals/textures
11/9	<b>CLASS EXAM</b>		20	9,10	Identifying Metamorphic Rocks
11/11	P-T diagrams and Reaction types				
11/14	Reaction rates		21	14,15	Pressure-Temperature Facies
11/16	P-T-time paths		22	16,17	Prograde/Retrograde Reactions
11/18	Metamorphic Compositions				
11/21	Ore generation		23	21,22	Ore minerals
11/23	No Class				No lab Wednesday or Thursday
11/25	Thanksgiving Holiday				
11/28	Radiometric Dating of Rocks I		24	28,29	Radiometric Dating of Rocks
11/30	Radiometric Dating of Rocks II			30,1	<b>LABORATORY FINAL</b>
12/2	Applications of Radiometric Ages				

12/7 **FINAL EXAMINATION WEDNESDAY AT 9 AM TO 12 PM**