

COURSE OUTLINE for GEOLOGY 365

INSTRUCTOR: Kurt Kyser (410 Miller)

DEMONSTRATORS: TBA

2004

TEXT: Intro to Geochem by Krauskopf and Bird or similar text. The chapters will not be discussed in lecture in their same order in the text, so read the appropriate chapter for each topic. Much of what will be given in lecture will not be discussed in the text, and the two should be complementary. If you do not attend the lectures (much of the material is not in books), you will have great difficulty in the exams, problem sets and labs.

The course will include three labs. These labs are designed to give you real experience in some of the concepts we will be discussing. Each will be done over several lab periods and will require a maximum 5 page report from each of you, even though the actual lab work will be done as a group of 2-4 people. There will be a tour of the geochemistry facilities in the Department as part of these labs. Those weeks when there is no lab work will consist of tutorials during which you should be able to complete most of the problem sets. The problem sets should be your own work only, although you may interact with each but not to the point where the input is imbalanced (i.e. do not copy!). The problems can be discussed during the lab period. The demonstrators have fixed office hours and should be consulted only then unless other arrangements are made.

WEB-BASED MATERIAL: The problem sets, solutions and diagrams used in the lectures will be available as pdf files on a web site located from the Geology Dept. web page. These should be printed and used to follow the lectures. Note that only selected diagrams will be available and the others will have to be taken as notes during the lectures.

<u>Date (approx)</u>	<u>Material to be covered</u>	<u>Problem set</u>
Jan 5-9	<u>Introduction.</u> The elements, who are they, what are they, where are they, and how do they dress?	
Jan 12-16	<u>Planets,</u> the solar system, meteorites and condensation models in relation to the structure and composition of the earth	#1-Review of basic principles due Jan 19
Jan 19-23	<u>Phases.</u> Volcanic systems and the need for binary phase diagrams; equilibrium and fractional crystallization in 1 and 2 component systems; more complex phase relations-3 components and how these relate to the origin of silicate liquids; brine phase equilibrium and fluid inclusions.	#2-Phase equil due Jan 26
Jan 26-30	<u>Thermodynamic</u> principles, free energy, enthalpy, entropy and equilibrium. What is the "ideal" world and how phoney is it? What are activity (effective concentration) and fugacity (thermodynamic pressure) and how can they be used? Effect of composition, temperature and pressure on the free energy of formation, energy of reaction and equil constant. What factors make solids, gases, solutes and solvents less than ideal, and how do we deal with reality?	#3-Thermo due Feb 9
Feb 2-6	<u>Acids</u> and bases, application of Eh and pH to solving problems.	
Feb 11	Review session	
Feb 12	MIDTERM EXAM	

Feb 16-20	Reading week	
Feb 23-27	<u>Kinetics</u> , activation energies, weathering are kinetics and Thermodynamics at odds?	#4-Eh & kinetics due March 1
Mar 1-5	<u>Organic geochemistry</u> --what are the big problems and what does geochemistry have to do with them? What happens when we die and why would we care? What is petroleum and from where does it come? Organisms and geochemistry.	
Mar 8-19	<u>Carbonates</u> . Application of geochemistry to big "problems" in geology—the dolomite, aragonite, kinetics and clay mineral quandaries.	#5-Organic geochem due March 15
Mar 22-26	<u>Stable isotope geochemistry</u> --what are stable isotopes, why do they fractionate, what is the effect of pressure and temperature and how can they be used.	
Mar 29-Apr 2	<u>Radiogenic isotopes</u> --half lives and their usefulness in absolute Dating. Isotopic tracers and their power and pitfalls.	#6-Isotopes due March 29

FINAL EXAM (comprehensive, but emphasis on the latter topics)

All problem sets are due in Lab or 410 Miller.

Final grade will be determined as follows:

Problem sets will be worth 20% of the final grade
Midterm exam will be worth 20% of the final grade
Final exam will be worth 35% of the final grade
Labs will be worth 25% of the final grade