SUNY Cortland
Department of Geology

GLY 560 – Thermodynamics and Isotopes in Geology

Professor: Dr. Robert Darling
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Credit hours: 3
Semester: Fall 2009
Lecture: Bowers 339, Wednesdays 4:20 to 6:50 pm

Course Description

Application of selected chemical principles (thermodynamics, phase equilibria, light stable isotope systematics, radiometric dating techniques) in the study of geologic problems. Prerequisite: GLY 261; CHE 221, 222. (3 cr. hr.)

Course Attendance Policy

Don't miss class. Because this class is scheduled for one night a week only, missing a class is the equivalent of missing a whole week's worth of material.

Evaluation of Student Performance

Your final course grade will be based on a midterm and final exam, an oral presentation and work assignments. The relative weight of each is outlined below along with letter grade numerical equivalents. All course requirements must be completed to receive a grade.

Final Grade = Midterm Exam = 25 % Oral Presentations = 10 % each (total 20 %)
Final Exam = 25 % In-class and homework assignments = 30 %

Grades =					
	A+ = 97-100	B+ = 87-89	C+ = 77-79	D+ = 67-69	
	A = 94-96	B = 84-86	C = 74-76	D = 64-66	
	A- = 90-93	B- = 80-83	C- = 70-73	D- = 60-63	E = 0-59

Disability Statement: If you are a student with a disability and wish to request accommodations, please contact the Office of Student Disability Services located in B-1 Van Hoesen Hall or call (607) 753-2066 for an appointment. Information regarding your disability will be treated in a confidential manner. Because many accommodations require early planning, requests for accommodations should be made as early as possible.

Academic Integrity: All students in this class are expected to adhere to academic integrity guidelines as outlined in the College Handbook. Any violation will be handled according to college policy.

Course Schedule and Activities

Sept. 2	Introduction to *Thermodynamics;* Chemical Energy & Chemical Equilibria *Gibbs Free Energy*, *the Equilibrium Constant*; Thermodynamics Exercises at 25°C and 1 atm. (in class).
Sept. 9	Thermodynamics in Geology *at high temperature and pressure*; Thermodynamics Exercises at elevated temperature and pressure (in class).
Sept. 16	Thermodynamics of *Minerals and Gases* in Geology: T-fO_2 diagrams; fO_2- fS_2 diagrams Thermodynamics Exercises under varying fO_2 and fS_2 (in class).
Sept. 23	Thermodynamics of *Aqueous Solutions* of the Earth: fO_2- pH diagrams Thermodynamics Exercises under varying fO_2 and pH (in class). Research papers on Thermodynamics in Geology assigned.
Sept. 30	The stability of secondary Cu minerals as a function of fO_2- fS_2. Thermodynamics Exercise of Cu mineral stability (in class).
Oct. 7	Phase Equilibria in the H_2O system
Oct. 14	Application of Thermodynamics in Geology Oral Presentations.
Oct. 21	**Midterm Exam** (2 hrs, 30 minutes)
Oct. 28	Introduction to light stable isotopes (H and O) Fractionation of light stable isotopes (H and O) in nature. Assignment of research papers on application of H and O isotopes in Geology.
Nov. 4	Application of light stable isotopes (H, O, S) in Geology Assignment of research papers on application of O and C isotopes in Geology.
Nov. 11	Oral presentations on application of H and O isotopes in Geology. Other light stable isotopes (C).
Nov. 18	Oral presentations on application of O and C isotopes in Geology. Fundamentals of radiometric dating: alpha decay, beta (negatron) decay; positron decay, electron capture. U and Th decay series; useful and non-useful radioactive isotopes; Assignment of research papers on application of U-Pb dating techniques.
Nov. 25	No class, Thanksgiving Break.
Dec. 2	U-Pb method of radiometric dating; Derivation of the age equation; The two U chronometers; Concordia diagram; Concordance versus discordance; Examples of common applications, Modern techniques including SHRIMP.
Dec. 9	The isochron method of dating; Modification of the age equation; U-Pb; Rb-Sr, Sm-Nd, Re-Os; Lu-Hf isochrons. Oral presentations on application of U-Pb dating techniques.
Dec. 16	**Final exam** (4:20 pm; room 339 Bowers).