004:131. Physical chemistry I. Spring 2007.
Syllabus

Instructor: **Anatoly Chernyshev**; 331 CB; 335-1108; anatoly-chenyshev@uiowa.edu

Office Hours:
Mon 10:00-11:00; Wed 10:00-11:00. Appointments available.

Teaching Assistants: TBA

Main textbook: *Physical Chemistry, 8th ed*, by Atkins P. and de Paula J.; Student solutions manual.

Supplementary textbooks: *The Feynman Lectures on Physics*; Berry S., Rice S.A., Rose J. *Physical Chemistry*;
Prigogine, I., Defay R. *Chemical Thermodynamics*.

Prerequisites:
004:012 or 004:014, and 22M:022 or 22M:026 or 22M:036 or 22M:046, and 029:012 or 029:082

***Objectives*:**
Physical chemistry is a discipline, which studies and interprets chemical phenomenae in a quantitative, physical way.
This course will cover basics of one branch of physical chemistry - chemical thermodynamics, with some extensions to electrochemistry.
Primary target audience for the course are chemistry, biochemistry and chemical engineering majors.

Lectures: TBA

Discussion Sessions:
You should be registered for a discussion session. A teaching assistant will conduct discussion sessions at the times listed below. This provides a good opportunity to have questions answered, to work assigned problems, and to have concepts explained from a different perspective.
Dis 001 TBA
Dis 002 TBA

Problem sets will be given about three times per month.

Exams:

Two intermediate two-hour exams are to be scheduled as below. The final exam is TBA.

Tentative schedule:

		Section	
1	Introduction and outline of the course.		
2	Ideal gases.	1	
3	Real gases. Fugacity. Virial equations.	1	
4	Work, heat, energy.	2	**January**
5	Heat capacity.	2	
6	State functions. The first law of thermodynamics. Enthalpy.	2	
7	Enthropy.	3	
8	The second and third laws. Ortho-para conversion of hydrogen. Gibbs paradox.	3	
9	The Gibbs and Helmholtz energies. Redox potential.	3	
10	Adiabatic processes.	2.6	
11	Chemical potential and equilibrium	7.1-7.4	
12	Equilibrium in heterogeneous systems.		
13	Liquid-vapor equilibrium	18.6-18.8	**February**
14	Liquid-solid equilibrium. Surface tension. Capillary action.	18.6-18.8	
15	Liquid-liquid equilibrium. Steam distillation.	5.4-5.5	
16	Solid-gas equilibrium. Sublimation.		
17	Thermodynamics of the surfaces. Adsorption. Adsorption isotherms.	25.1-25.5	
18	**Review session**		
19	Solutions. Solvatation. Concentration and activity.	5	
20	Raoult and Henry's laws.	5	
21	Boiling and freezing points.	5	
22	Gibbs-Duhem equation.	5	
23	Ionic strength. Debye-Huckel theory. Osmosis.	F5.1; I5.2	
	Spring break		
24	Phase definition. The phase rule.	6	
25	One-component systems. Definition of phase transitions.	4	
26	Phase stability. Clausius-Clapeyron equation.	4	

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27	Phase diagrams.	4, 6	
28	Two component systems.	6	
29	Distilation. Azeotropes.	6	
30	Crystallization. Eutectics. Congruent and incongruent melting.	6	
31	Electron transfer. Half reactions. Nernst equation.	7.5-7.9	
32	Electric double layer.	25.8	
33	Electrochemical equilibrium. Pourbaix diagrams.	7.5-7.9	
34	**Review session**		
35	Phase space. Configuration points.		
36	Microscopic and macroscopic state.	16	**April**
37	Statistical ensembles.	16	
38	Partition function.	16	
39	The statistical entropy.	16	
40	Maxwell-Boltzmann, Fermi-Dirac, and Bose-Einstein distributions	16	
41	Applications of statistical thermodynamics.	17	
42	Statistics of polymer chains.	I16.1	
43	Concluding remarks		**May**