Lewis & Clark College
Chemistry 310: Physical Chemistry
(Thermodynamics and Kinetics)
Spring 2008

Basic Information:

Professor: Barb Balko; Olin 225; x 7534; balko@lclark.edu
Office Hours: Tuesday 2 – 3, Wednesday 11:30 – 12:30, and Friday 3 – 4; also, by appointment
Lectures: MWF, 9:10 – 10:10, Olin 102
Text: Chang, *Physical Chemistry*
Class Listserver: 07sp-chem-310-01@lclark.edu
Class Website: www.lclark.edu/~balko/chem310.htm

Course Information:

Thermodynamics and kinetics are fundamental to chemistry and biochemistry. Thermodynamics allows one to determine whether a reaction will spontaneously occur, how much energy will be released or consumed by the reaction, and how far the reaction will have proceeded once equilibrium is established. Kinetics tells one how fast spontaneous reactions will go and can help identify reaction mechanisms. The two subjects go hand in hand. Consider a "reaction" that doesn't occur. It may not occur for kinetic reasons or because it is not thermodynamically allowed.

Understanding thermodynamics will also allow you to answer certain questions you may have asked yourself, such as: (1) why is it colder on top of mountains (despite being closer to the sun)?, (2) why does your tire pump get hot when you're pumping up your bike tire?, (3) why is anitfreeze useful in both the summer and winter?, (4) why are recipes modified for cooking at high altitudes?, (5) how do skates help you ice skate?, and (6) what conditions are necessary to convert the graphite in pencils into diamonds? You'll find too that thermodynamics and kinetics govern many biological processes.

Course Strategy:

Reading the text, doing all the assigned homework, and coming to class are essential for doing well in the course. Doing extra problems is especially helpful. While rote memorization is not emphasized in this class, you should be doing enough reading and problems that you know most of the constants and equations without looking at the text. I encourage you to form study groups and can help get these groups together and/or can suggest problems to work on. Please see me if you are having any difficulties.

Some students worry about the amount of math required for the class. Calculus I and II are prerequisites for the class. The calculus used in this course is primarily derivatives and simple integrals. Don't forget your algebra skills, however! I will be happy to help you with any math that you have forgotten, but you will be expected to be able to do the problems on your own.

Grading:

3 Tests (equally weighted)	60%
Final	20%
Homework	10%
In-class participation	10%

Tests

Three tests will be given. The **approximate** dates for the tests are as follows: February 18 (after we complete Chapter 4), March 10 (after we complete Chapter 6) and April 6 (after we complete Chapter 10).

Final Exam

The final will be cumulative and will be on Thursday, May 8, 8:30 – 11:30 am in Olin 102.

Homework

Homework will be assigned for each chapter (~ once a week). Solutions will be posted on the class webpage after the work has been collected. Work will be accepted up to one week late with a 10% penalty. I encourage students to work on problems in groups but the work you turn in should represent your own efforts (i.e., not directly copied from a classmate).

In-Class Participation

To help me understand how well the class understands the material as well as to encourage the class to ask questions and absorb the material, I will have you work on "in-class" activities during class that you will then turn in. The work will be graded as follows: 0 for an unexcused absence, 75 for incomplete work, 85 for standard work, and 95 for exceptional work. I will drop your three lowest grades.

Academic Honesty:

I expect academic honesty. This means homework and tests should be your own efforts. Discussion about homework assignments is encouraged but the work you turn in should be your own (i.e., it should be in your own words and you could explain it fully if asked). Cheating will result in failure on the assignment, possible failure of the course, and a hearing by the student Honor Board. Please consult the *Pathfinder* for more information on the College's academic integrity policy. If you are having problems come see me!

Learning Accomodations:

If you have a disability that may impact your academic performance, you may request accommodations by submitting documentation to the Student Support Services Office, and that office will notify me of the accommodations for which you are eligible.

Tentative Class Schedule

Dates	Topic	Chapter
Wed., Jan. 23	Review of Gas Laws	2.1 – 2.7
Fri., Jan. 25	Real Gases	2.8 – 2.9
Mon., Jan 28	Gas Particle Velocity	3.1 – 3.4
Thurs., Jan 31	**Focus the Nation – No Class**	
Fri., Feb, 1	Collisions	3.5, 3.7, 3.8
Mon., Feb. 4	Work: Reversible and Irreversible 1^{st} Law of Thermodynamics	4.1 – 4.2
Wed., Feb. 6	Enthalpy and Heat Capacity	4.3 – 4.4
Fri., Feb. 8	Adiabatic Expansion	4.5
Mon., Feb. 11	ΔH_{rxn}	4.6 – 4.7
Wed., Feb. 13	Carnot Engine and Entropy	5.1, 5.3
Fri., Feb. 15	Development of the 2^{nd} Law of Thermodynamics	5.4
Mon., Feb. 18	**Test #1**	
Wed., Feb. 20	Entropy Changes	5.5
Fri., Feb. 22	3^{rd} Law of Thermodynamics and other definitions of entropy	5.2, 5.6, 5.7
Mon., Feb. 25	Gibbs Energy	6.1 – 6.3
Wed., Feb. 27	Dependence of ΔG on T	6.4
Fri., Feb. 29	Dependence of ΔG on P	6.4
Mon., Mar. 3	Clausius-Clapyeron Equation	6.5
Wed., Mar. 5	Partial Molar Quantities	7.1 – 7.2
Fri., Mar. 7	Using Chemical Potentials, Raoult's Law	7.3 – 7.4
Mon., Mar. 10	**Test #2**	
Wed., Mar. 12	Non-ideal solutions, Henry's Law	7.4 – 7.5
Fri., Mar. 14	Colligative Properties	7.7
Mon., Mar. 17	Thermodynamics of Ions in Solution and Activity (overview)	8.1 – 8.5
Wed., Mar. 19	Donnan Effect and Membrane Transport	8.6 – 8.7

Fri., Mar. 21	Equilibrium Constant	9.1 – 9.3
Mon., Mar. 24 – Fri., Mar. 28	**Spring Break**	
Mon., Mar. 31	Dependence of K on P and T	9.4
Wed., Apr. 2	Using K	9.5 – 9.6?
Fri., Apr. 4	Galvanic Cells	10.1 – 10.2
Mon., Apr. 7	Nernst Equation	10.3, 10.5
Wed., Apr. 9	**Test #3**	
Fri., Apr. 11	Electrochemistry Applications	10.6, 10.8, 10.9?
Mon., Apr. 14	Reaction Rates and Orders	12.1 – 12.4
Wed., Apr.16	Activation Energy	12.5 – 12.6
Fri., Apr. 18	Transition State Theory	12.7 – 12.8
Mon., Apr. 21	Reaction Mechanisms	12.4
Wed., Apr. 23	Catalysis	13.1
Fri., Apr. 25	Enzyme Kinetics	13.2 – 13.4, 13.6
Mon., Apr. 28	Inhibition	13.5, 13.7
Wed., Apr. 30	Review	
Thurs., May 8	**Final, 8:30 – 11:30**	