CHE 371: Kinetics and Thermodynamics
Fall 2007

Class Meetings: Lecture: M, T, W, F 9:00 AM, Olin 103
Laboratory: T,W 1:30-5:20 PM, R 2:30-6:20 PM
Office Hours: By appointment (between 7:30 AM and 5:00 PM)

Instructor: Prof. Amanda Nienow, Nobel 106A, x7327, anienow@gustavus.edu

Textbook: Donald A. McQuarrie and John D. Simon. *Physical Chemistry: A Molecular Approach*. University Science Books, Sausalito, CA. 1997.

Website: http://homepages.gac.edu/~anienow/CHE-371/che_371.html

Course Overview:
Physical chemistry is the quantitative interpretation of the macroscopic properties of matter informed by a detailed understanding at the atomic and molecular level. Physical chemistry is an exciting field with important connections to topics as diverse as protein folding to the ozone hole to rational drug design and to organic synthesis. Thermodynamics is a subject that quantifies the stability of macroscopic systems, the flow of energy between macroscopic systems, and the ensuing transformations that occur. Physical chemistry unifies the laws of thermodynamics that predict the likelihood of chemical transformations, chemical kinetics that indicate how fast a chemical transformation will occur, and adds the insights gained at a molecular level to make solid predictions of the chemistry of matter. In this course, we will study the application of thermodynamics and kinetics to chemical systems providing an important foundation for the understanding of chemical and biochemical systems.

Attendance Policy:
Class: The material presented in this course can be abstract and mathematically challenging, and seeing it in class will be helpful to your understanding. With that said, I understand that we are all busy adults, and that there may be an occasion on which you need to miss class. Therefore, you are allowed **four** absences *from class* without any negative consequences. Although I do not need any explanation for the first four absences, I do request that you discuss your absence with me in advance (even 10 minutes before class via phone or e-mail) so I am not waiting for you to begin class. Additional absences will result in a drop in your grade (5-10 absences) or an automatic failure (10 or more absences).

Lab: To get credit for laboratory assignments, you **must** be present. I will make exceptions to this rule only for emergencies and illness. If this need arises, please inform me as soon as possible.

Problem Sets: Working problems is essential to the mastery of the material in physical chemistry. In this course, there will be several (~7) lengthy homework sets due throughout the semester. For each homework assignment, there will be a corresponding review session. In these sessions, three homework groups will present the solution to three of the assigned problems. In addition, I will be available to answer questions on other problems. On select review days, there will be short quizzes on the material. Unless noted, the review sessions will be held on Fridays with the homework due the following Monday. After Thanksgiving Break, this general rule will be broken. These problem sets will be graded on a √–, √, or √+ basis.

Also note that some of the problems in each homework set will be from material we haven't yet covered in lecture (e.g., we may not be done discussing Ch 16 by 9/17).

Homework #	Topic	Review Date	Due Date
1	Quantum Mechanics, Ch 16	9/14	9/17
2	Ch 17, Ch 18	9/21	9/24
3	Ch 19, Ch 20	10/12	10/15
4	Ch 21, Ch 22	10/26	10/29
5	Ch 23, Ch 24, Ch 25	11/16	11/19
6	Ch 26	11/27 WED	11/28 THURS
7	Ch 28, Kinetics	12/7	12/14 FRI

Exams and Quizzes:

There will be three term exams and a final exam. These exams are tentatively scheduled:

Exam 1: QM, Ch 16-18 of McQuarrie and Simon, Friday Sept 28, 2007
Exam 2: Ch 19-22 of McQuarrie and Simon, Friday November 2, 2007
Exam 3: Ch 23-26 of McQuarrie and Simon, Friday November 30, 2007
Final Exam: Cumulative (QM, Ch 16-28) with emphasis on kinetics, TBA

On select review days, there will be short quizzes on the material at hand. The tentative dates for these quizzes are listed above.

Students must arrange **in advance** to take an exam at any other than the scheduled time, and may do so only for a valid health or school-related activity. Exams missed without pre-arrangement are entered as zero credit and cannot be made up.

Grading:

Your course grade will be based on a combination of an absolute scale for exam grades, combined with a curve that may be applied at the end of the course if needed to *raise* the overall class course grade distribution. The absolute grading scale ensures that students have some sense of where they stand with respect to grades throughout the course, and may help encourage group studying without a sense that people are competing with each other. This combined absolute and curved grading method is described further below.

Grading Itemization:

Homework, Quizzes, and Review Presentation:	150 pts (20%)
Exams (3 @ 100 pts each):	300 pts (40%)
Laboratory (Reports, Notebooks, Project)*:	150 pts (20%)
Final Exam:	150 pts (20%)
Total:	*750 pts (100%)*

* You **must** pass the laboratory portion of this class to receive a passing grade in the course.

Absolute exam grading scale: Grade ranges for final grades, expressed as a percentage of the maximum possible points (i.e., 750 pts) are:

	B+ 86 - 88 %	C+ 76 - 78 %	D+ 66 - 68 %
A 93 - 100 %	B 82 - 85 %	C 72 - 75 %	D 60 - 65 %
A- 89 - 92 %	B- 79 - 81 %	C- 69 - 71 %	F 0 - 59 %

Curved exam grading scale: Depending on the class performance, at the end of the semester (after the final exam) the cutoffs above may be *lowered* (but they will not be raised) if needed to *raise* the average course grade to between a B- and C+. That is, the above absolute grading scale may be modified by a curve in the favorable direction, if needed to ensure that at least half of the students receive course grades in the A or B range (including +/-).

Laboratory:

Experimentation plays an integral role in the course. The laboratory offers the opportunity to put your conceptual understanding of the subject to work. Last year's lab manual is online at: http://www.gac.edu/oncampus/academics/chem/pchem/Thermo.html. Supplements to this manual may be supplied during the course of the semester.

There will be three laboratory sections on Tuesday, Wednesday and Thursday afternoons starting at 1:30 PM (T, W) and 2:30 PM (R). Note: The laboratory instructor for the Wednesday course is Dr. Jonathan Smith. Each investigation will require careful preparation including preparing your notebook and reading the material in the handout as well as any literature articles required for the investigation.

Careful record keeping in a laboratory notebook is critical to this laboratory work. Your notebook should be bound with consecutively numbered pages. Each page should be dated, and a table of contents should be kept at the front of the book. Notes on the operation of instruments, summaries of the experiments, and observations made in lab must be noted in pen. Spectra, and other data, can be taped or pasted into the book. Results, in the form of tables where applicable, and any related calculations, should be included. Notebooks will be collected at the end of the semester and checked for completeness.

A brief but carefully written report will be turned in at the beginning of laboratory one week following completion of an investigation (5% penalty per day late). The word processed report will include a brief summary of the goals of the investigation, carefully tabulated experimental data (including any spectra or other raw electronic data), analysis, and responses to questions. This will be discussed in detail in the first lab session.

Date(s)	Investigation	Report Due
Sept 4-6	Intro to P Chem Lab	N/A
Sept 11-13	Computational Study of Heats of Formation and Combustion of Hydrocarbons	Sept 18-20
Sept 18-20	Spectroscopic and Theoretical Determination of Flame Temperature	Sept 25-27
Sept 25 – Nov 1 (4 weeks)	Bomb Calorimetry and Determination of Resonance Energy of Benzene	1 Week from end of each lab session
	Determination of the Heat of Vaporization of Various Liquids	
	Solution Kinetics of an SN2 Reaction	
	Kinetics of a Diffusion Controlled Reaction as Measured by Fluorescence Spectroscopy	
Oct 2-4	Nobel Conference: No Lab	NA
Oct 23-25	Reading Days: No Lab	NA
Nov 6-15 (2 Weeks)	Computational and Experimental Study of Isomerization in N,N-dimethylacetamide (DMA)	Nov 20 (In class)
Nov 27-Dec 13 (3 Weeks)	Independent Projects	Dec 11-13

Course Topics:
In the Table below, the topics and chapters listed refer to: Quantum Mechanics = Review; Ch 16 = Properties of Gases, Ch 17 = Boltzmann Factor and Partition Functions, Ch 18 = Partition Function and Ideal Gases, Ch 19-21 = The Laws of Thermodynamics, Ch 22 = Helmholtz and Gibbs Energies, Ch 23 = Phase Equilibria, Ch 24-25 = Solutions, Ch 26 = Chemical Equilibrium, Ch 28 = Kinetics

Dates	Topcis/Textbook Chapters	Items of Interest
Sept 4-7	Quantum Mechanics, Ch 16	
Sept 10-14	Chapters 16 and 17	
Sept 17-21	Chapters 17 and 18	
Sept 24-28	Chapter 18	**Exam 1:** QM, Ch 16-18, Sept 28
Oct 1-5	Chapter 19	**Nobel Conference**: Oct 2 &3
Oct 8-12	Chapters 19 and 20	
Oct 15-19	Chapters 20 and 21	No Homework Review Session
Oct 22-26	Chapter 21	**Reading Days**: Oct 22 and 23
Oct 29- Nov 2	Chapter 22	**Exam 2**: Chapters 19-22, Nov 2
Nov 5-9	Chapters 23 and 24	
Nov 12-16	Chapters 24 and 25	
Nov 19-23	Chapter 26	**Thanksgiving**: Nov 21-Nov 23
Nov 26-30	Chapter 26, Exam Review	**Exam 3:** Ch 23-26, Nov 30
Dec 3-7	Chapter 28, Kinetics	
Dec 10-12	Kinetics, Final Exam Review	
Final Exam	**Cumulative: QM, Ch 16-28**	**TBA**

Gustavus Honor Code:

Gustavus has adopted an honor code. Each of you is required to abide by the following pledge: "As a community of scholars, the faculty and students of Gustavus Adolphus College have formulated an academic honesty policy and honor code system, which is printed in the Academic Bulletin and in the Gustavus Guide. As a student at Gustavus Adolphus College I agree to uphold the honor code. This means that I will abide by the academic honesty policy, and abide by decisions of the joint student/faculty Honor Board." Pledge: “On my honor, I pledge that I have not given, received, or tolerated others use of unauthorized aid in completing this work.”

In physical chemistry you will work together on problems in study groups and you will work together in laboratory but you will still be required to turn in work that is **solely** your own. On exams you will not receive any assistance and will add the following pledge: "On my honor, I pledge that I have not given, received, or tolerated others' use of unauthorized aid in completing this work."

The penalty for not adhering to the honor code will range from taking a zero on the particular piece of work in question to referral to the honor board depending on the circumstances.

Accommodations:

If you have a physical, psychiatric/emotional, medical, or learning disability that may have an effect on your ability to complete assigned course work, please let me know. I will provide assistance and accommodations upon receiving verification from Laurie Bickett in the Academic Advising Center. The Gustavus Adolphus College policies on this matter can be found at www.gustavus.edu/oncampus/advising/disability.cfm.