Biochem 471/Chem 471 - Fall 2008

MWF 10:10 A.M., 227 Chenoweth Lab

Instructor: David Gross, LGRT 824
Office hours: 1:30-3:00 W and Th or by arrangement.
Phone: 545-3170
E-mail: dgross@biochem.umass.edu

TA: Jacob Harvey, LGRT 1115C
Office hours: 12:30-2:00 M and F
Phone: 603-630-1586
Email: jaharvey@chem.umass.edu

Course Website URL: http://people.chem.umass.edu/dgross/chem471/

TEXTBOOK: David Gross, *Physical Chemistry: Applications in the Life Sciences* (electronic text available free via the OWL system)

The text for the course is a new electronic textbook linked to the UMass OWL system. It is in draft form and is being continually revised, but will be the reference text for the course. If you would like a hardcover book for reference purposes, Tinoco, Sauer, Wang & Puglisi, *PHYSICAL CHEMISTRY Principles and Applications in Biological Sciences* (4th Ed., Prentice Hall) is available in the bookstores as an optional text. It is also available on reserve at the DuBois library.

Goals and Expectations. Chemistry 471 is a one semester course that surveys fundamental aspects in all areas of physical chemistry with application to the biochemical sciences. The material in the course will cover four broad areas:

1. Thermodynamics (examining the macroscopic properties of chemical systems at equilibrium)
2. Statistical thermodynamics (serving to connect molecular properties to macroscopic observables)
3. Kinetics (the study of chemical reaction rates)
4. Quantum mechanics and spectroscopies (observing the underlying quantized nature of matter)

Most students in this course are interested in the life sciences and will soon be choosing a more specific career path, whether it is medicine, research, or both, and whether it is in industry, graduate school, academia, or something completely different. Irrespective of <u>your</u> choice, the study of physical chemistry is an essential part of modern day biology. Recent rapid advances in biology, marked by the completed genome sequences of many organisms and the large-scale initiatives in structural genomics illustrate the great deal of attention aimed at finding a 'complete' molecule-based description of life. Physical chemistry provides fundamental explanations of all chemical processes, and thus of biology. As a result an appreciation of physical chemistry, even at an elementary level, is important to understand biological processes.

<u>*To perform well in this course, you will need to:*</u>

1. be familiar with the structural and chemical properties of biological molecules: proteins, nucleic acids and their building blocks, *i.e.* have a background knowledge of biochemistry.
2. have a working knowledge of algebraic methods, single variable calculus, integration, differentiation, and the properties of exponential and logarithmic functions.
3. be conversant with basic physics, which includes a knowledge of the units of mass, distance, time and temperature along with the relationship of these units to physical variables such as energy, force and velocity.

During this course you are expected to:

1. attend class, participate in class discussion, be attentive, ask questions.
2. read the textbook, do homework problems, and ask questions about the reading assignments.
3. complete OWL problems and exams.

Grading

COURSE REQUIREMENTS:	Points	Total Points
Examples in the eBook	5	5
OWL self-paced homework	25	25
OWL timed quizzes (5)	2 (ea)	10
Hour Exams (2)	20 (ea)	40
Final Exam	20	20

OWL. The OWL (Online Web-based Learning) homework system may be familiar to many of you. In this course there will be exercises posted at regular intervals as the semester progresses. These exercises can be worked at your own pace. All will have the same due date: December 14 at midnight. It is strongly recommended that you complete the exercises as the semester progresses. The exercises will be based on material concurrently discussed in lecture. The exercises will be graded based on the number of correct units over the whole semester. You may work the exercises multiple times. The graded OWL homework problems will count for a maximum of 25 total points.

OWL timed quizzes. Approximately each week and a half a timed quiz will be administered via OWL. The quiz may be taken within a window of time (usually 3 days). Quizzes must be completed within a set time (usually 40 minutes) once started. OWL quizzes cannot be repeated. Your best five of seven timed quiz grades will count for a maximum total of 10 total points.

Textbook example problems. The electronic textbook will be available via login through the OWL system. A number of interactive example problems are included with the reading assignments. Two points will be given for completing half of the problems successfully. An extra three points will be given if you successfully complete ¾ of these example problems. An extra two points will be given if all of the problems are completed successfully. The due date for all textbook example problems is December 14.

Written exams. Three written exams will be given. Two midterm evening hour exams will each cover the material from the preceding third of the course. The two midterm exams are scheduled for Thursday, October 9 at 7:00 PM and Thursday, November 6 at 7:00 PM. Both will be in Goessmann 20. The third exam covering the last 1/3 of the course material will be held Thursday, December 18 at 4:00 PM in ECSC 119. The exams will each be worth 20 points each. The third exam is not cumulative.

Exams and exam answers from 2004-2007 are on the course website. In 2004 and 2005 8 half-hour exams were given along with a cumulative final exam. In 2006 only one midterm exam was given. Questions on this year's midterms and final exams will be similar to those on the old exams.

Excused & Unexcused Absences:
Unexcused absences generate grades of zero for examinations missed.
Excused absences require prior notification:

1. Excused absences for reasons of religious observance are allowed provided that you notify me of conflicting dates 1 week or more prior to the conflict.
2. Excused absences for medical and other personal emergencies must be verified in writing by a physican, or another appropriate contact person. Obviously, if you are in the emergengy room and unable to notify me, prior notice will not be necessary.

Grade Policy. Course grades are determined by a curve where the grade average of the whole class will be no worse than a B- and grades approximately within a standard deviation of the average will be A- and C-, respectively.

Academic Honesty: See the regulations on "Academic Honesty" in the Student Handbook, "Undergraduate Rights & Responsibilities". Dishonesty is not tolerated at the Unversity. Working together is a natural and necessary part of the scientific process. It is appropriate to study together, to work problems (including the homework assignments and OWL exercises) together and to seek out assistance with course material. It is <u>not</u> appropriate to work together or to copy during the exams, both on OWL and written. Note that examinations will include values of constants, formulae, etc., so there is no need to memorize them.

Violations of the Academic Honesty policy will be reported to the University's Ombuds Office as described in University regulations. If you have any questions as to the appropriateness of an activity in relation to the Academic Honesty policy, check with the instructor for clarification.

Course Outline. Course material will be presented in four segments: (*i*) Thermodynamics and reactions, (*ii*) Statistical nature of molecular dynamics, (*iii*) Kinetics of reactions, and (*iv*) Quantum theory & spectroscopy with applications.

Dates	Segment	Topics	Text Chapters
Sep. 2- Oct. 14	Thermodynamics & equilibria	*Thermodynamics*	Chapters 2-7
Oct. 15- Nov. 5	Molecular motion & Statistical effects	*Colligative properties, molecular distributions, molecule statistics*	Chapters 8 & 9
Nov. 10- Nov 17	Reaction kinetics	*Chemical reactions* *Enzyme kinetics*	Chapter 10
Nov. 19- Dec. 12	Quantum theory & spectroscopy	*Quantum chemistry & atomic structure* *Spectroscopy* *Macromolecule structure determination*	Chapter 11