CHEM 482: Section 0102: MWF, 9:00-9:50am, Chemistry 0119
Spring 2004

Prof.: David Fushman
Office: Room 1121 Agriculture/Life Sciences Surge Bldg (#296); x53461, **fushman@umd.edu** (much preferred to phone), Please restrict telephone inquiries to office hour times, except in "emergencies". Email is welcome anytime.
Office hours: Wednesday, 2:00-3:30pm

Teaching Assistant: Aydin Haririnia
Office hours: Monday, 12-2pm, Thursday, 12-2pm, Room 1109, Agriculture/Life Sciences Surge Bldg (#296), x51989, **aydin@wam.umd.edu**

Course Description

This section of the Physical Chemistry course is designed to cover topics that are particularly relevant to problems and applications of physical methods to modern biochemistry. There is significant emphasis on various experimental techniques: sedimentation, chromatography, electrophoresis, relaxation kinetics, a broad range of spectroscopies applied to biomolecules, and on methods for biomolecular structure determination.

Mathematical level required: physical chemistry is a quantitative discipline. Many of the problems and techniques discussed throughout the course require familiarity with the following mathematical methods: basic vector analysis, derivation and integration techniques, methods to solve differential equations, determinant and matrix calculus. Additional elements of linear algebra will be introduced in the quantum part of the course as required.

Textbooks:
Required: (1) David W. Ball, *Physical Chemistry*, Brooks/Cole –Thomson Learning;
(2) David Eisenberg, Donald Crothers, *Physical Chemistry with Applications to the Life Sciences*. Benjamin/Cummings Publishing Co.
Additional recommended sources: *Principles of Physical Biochemistry* by van Holde, Johnson & Ho; *Molecular Driving Forces* by Dill & Bromberg; *Biophysical Chemistry* by Cantor & Schimmel.

There is a course homepage at:

http://gandalf.umd.edu/CHEM482/

where you will find a copy of the syllabus, regular homework and reading assignments, homework problems, exam solutions and statistics, and extra materials. Some of these materials will be posted as we proceed with the course. You are welcome to email your questions and comments. I do not guarantee individual responses, but errors or common points of confusion will be addressed in class.

Course Outline

The exact order of topics and the number of lectures on each may change.

1. Statistical thermodynamics (4 weeks)
Review concept of partition functions. Applications to binding equilibria, single- and multicomponent systems, phase transitions. Statistical mechanics of biomolecules as polymer chains. Helix-coil transition, protein folding.
Kinetic theory of gases. Maxwell-Boltzmann. Review of solutions (non-ionic and ionic) and polyelectrolites. Transport phenomena, channels, diffusion equation, Brownian motion. Applications in biochemistry: dialysis, liquid chromatography, sedimentation, electrophoresis.
2. Chemical and biochemical kinetics (3 weeks)
General kinetics. Differential and integrated rate laws. Mechanisms of chemical and biochemical reactions, enzyme kinetics. Transition state theory. Diffusion-limited processes. Kinetics methods in Biochemistry.
3. Quantum Mechanics (6 weeks)
Postulates of quantum mechanics. Observables and operators, the uncertainty principle, wave functions and eigenvalues, Schrödinger equation. Quantization of energy, particle in a box, harmonic oscillator, rigid rotor, quantization of angular momentum. Hydrogen atom. Electron spin, Pauli principle. Atomic states. Molecules, rotation and vibration, Born-Oppenheimer approximation. Spectroscopy. Selection rules. Electronic spectra. Optical spectroscopy. Applications to biomolecules: absorption, circular dichroism, vibrational spectroscopy. Fluorescence techniques and applications to biomolecules. Magnetic resonance spectroscopy, applications to biomoleculal structure determination.
4. Diffraction, Scattering (1 week)
X-ray, electron, neutron diffraction, crystal structures, space symmetry groups. Methods for biomolecular structure determination.

Examinations will be given on the following dates (These exam dates are firm**):**

I	Wednesday, February 25
II	Wednesday, March 17
III	Monday, April 19
Final exam:	**Wednesday May 17, 8:00-10:00 am**

Grading Policies. Each exam during the semester will be worth 100 points and the final exam will be 150 points. Exams during the semester will include only the material covered since the previous exam but will inevitably draw on information from earlier in the semester. The final will cover the entire course material. The exams will include material covered in the lectures and in the corresponding sections of the textbook. There will be 5 graded homeworks, each worth 20 points. In addition, problem sets will be given as homework regularly: these are optional, however, completing them is likely to be very helpful in your preparation for the exams. All mid-term exams will be 50 min long and will be given in the lecture room (Chem 0119). You will be allowed to use calculators for computation only. Two of your three mid-term exams with the highest scores will count toward the final grade.

Your final letter grade will be based on your total score on all graded homeworks, on the two out of the three mid-term exams (with the highest scores), and on the final exam (maximum 450 points). Grading will be done on a *curve* based on the overall distribution of the *class scores*. You will be guaranteed an A if your total score is 85% or better, a B if it is 60% or better and a C if it is above 30% of the class. Final grading will then be done using the "+/-" grading system, as follows. The cut-offs for A, B, etc grades will be determined first. Then each letter-range will be divided into three groups: all students whose scores are in the upper third of, e.g. B range will be given a B+, those in the middle will receive a B, and the lower third will receive a B-, and so on.

Regrades.
If you think a mistake has been made in grading your work, you *must* submit it to me for regrading no later than one week after the date on which the work was returned to the class, with a written explanation of your reasons for desiring a regrade. The entire exam is subject to regrading, which often decreases the total score. After that, the grade will be considered final. Arithmetic errors in the grading can be corrected without regrading.

Make-up exam policy.
Do not miss any of the exams or homeworks. If you miss an exam, **you will have a score of "0" on the exam until it is made up.** Only students with **legitimate excuses** as determined by the University policy will be given a make-up exam. For a make-up exam you will need written documentation of the emergency or illness. **Graded homeworks are due by 10:00am (end of the class) on the due date, no late submission will be accepted.** A missed homework will be assigned a score of "0". **No homework will be accepted after its due date; there will be no make-up for missed homeworks.**

It is your responsibility to contact me promptly to schedule a make-up exam. In any case, YOU MUST CONTACT ME WITHIN 24 HOURS OF MISSING AN EXAM.

All students must take the final exam.
Please notify me as soon as possible if you know ahead of time that you will miss an exam for any reason, including previously scheduled events, religious observances, etc. According to the University policy you must tell me no later than Feb 6 (the last day of schedule adjustment period).

Teaching assistance.
The teaching assistant for this course is *Mr. Aydin Haririnia*, a graduate student in the Biochemistry program.
We are happy to help you with the material during office hours. If necessary, we will arrange other times to meet. A review session will be scheduled before the final exam. If you believe a mistake has been made in lecture (I guarantee this will happen), please speak up or inform me afterward. **Please ask questions in lecture if something is not clear.**

Academic integrity.
From the *Code of Academic Integrity*, University of Maryland, College Park:
"The University is an academic community. Its fundamental purpose is the pursuit of knowledge… Essential to the fundamental purpose of the University is the commitment to the

principles of truth and academic honesty. Accordingly, The Code of Academic Integrity is designed to ensure that the principle of academic honesty is upheld…"
The *Code of Academic Integrity* is available on the University web site at
http://www.inform.umd.edu/CampusInfo/Departments/JPO/code_acinteg2a.html
and is printed in the current Schedule of Classes. Students are responsible for knowing and understanding the content of the Code.
There will be zero tolerance to violations of the *Code of Academic Integrity*. Suspected cases will be reported immediately to the appropriate authorities. The standard penalty for violations of the *Code of Academic Integrity* is a grade of "XF"

Specific guidelines relevant to this course include:
1. All work that you submit for grading in this course (i.e. examinations) must be the original work of the student whose name is on the work.
2. You may use a calculator for most in-class exams, but **only** for computation. Any other use is a violation of the University's *Code of Academic Integrity*.
3. Other actions such as falsification of excuses for missed exams or submission of an altered, graded examination for regrading, etc., are also violations of the *Code of Academic Integrity* or the *Code of Student Conduct.*

Honor Pledge
The University of Maryland Honor Pledge reads:
"*I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.*"

The Pledge statement should be handwritten and signed on the front cover of all examination papers submitted for evaluation in this course. Students who fail to write and sign the Pledge will be asked to confer with the instructor. Further information about the Honor Pledge can be found on the University web page:
http://www.inform.umd.edu/CampusInfo/Departments/JPO/AI/honorpledge/