Instructor: Dr. Jeffrey A. Mack  
Office: 522C, Sequoia Hall  
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Office Hours: TBA and by appointment.

Prerequisites: 
Two semesters of engineering based calculus, equivalent to math 30, 31, on this campus, and one year of non-calculus based physics (equivalent to 5A and 5B here). If you don’t have these prerequisites, you need to talk with me.

Required Materials: 

Text: "Physical Chemistry: Principles & Biological Applications in the Biological Sciences" Tinoco, et. al.  

Supplies: Scientific (graphing) calculator, notebook and/or three ring binder for handouts

Course Description: 
CHEM 142. Introduction to Physical Chemistry. Introductory presentation of the theoretical and practical aspects of thermodynamics, quantum chemistry, spectroscopy, and kinetics. As time permits, other topics will be: solution chemistry, hydrodynamics, electrochemistry, and crystallography. Note: Not acceptable for the BS or the BA without concentration.

Course Objective: 
Introduction to Physical Chemistry course is a required course for students pursuing an undergraduate degree in chemistry with a concentration in biological chemistry or forensics. By definition, Physical Chemistry is the study of the underlying physical principles that govern the properties and behavior of chemical systems. As such, Physical Chemistry combines the principles of physics and mathematics as they apply to various chemical systems. The objective of this course is to introduce the theoretical and practical aspects of thermodynamics, kinetics, quantum chemistry and spectroscopy, and to provide each student with a solid foundation for future study in the field of chemistry.

Requirements and Expectations of the Students: 
1. Attend each class and problem session. Attendance is a critical factor in your learning process and especially is important in a chemistry course. Attendance alone will not guarantee passing.
Approximately 10% of learning comes from attending the class lectures. If you want to excel in the course, the rest is up to you.

2. Complete all assigned textbook readings, homework sets and special problems. It is crucial that you read over the material to be discussed prior to lecture. If you don’t, you will not receive the maximum benefit of the discussion.

3. Be an active, independent learner. As your instructor it is my goal to:
   1. Provide a logical and thorough overview of the material in lecture
   2. Provide helpful homework assignments related to the lecture
   3. Challenge your understanding of the course material.

As a student it is your goal to master the material and perform to the best of your abilities. In order to do so, you must take seriously your studies by dedicating at least 15-20 hours outside of class devoted to reading, reviewing, and working problems. Any less time and dedication limits your success.

4. If you are taking more than 12 units and working significant hours outside of school, you will more than likely do poorly in this course. I cannot offer any consideration towards your lifestyle choices. If you are too busy to devote adequate effort to this course, please be realistic and postpone taking chem. 142 until such time that you have the time.

**Exams:** There will be three hour exams (you can start at 7:45am):

The exam problems will be take directly form the HW, Quiz and Lecture problems. For each exam you may bring one page of equations only. This will be further discussed in class prior to the exam.

There will be no make-up exams given. If you have a conflict with a date, you may take the exam early as long as you notify one week prior. Exams may only be excused for a documented emergency reason. If you miss an exam, your total score will be adjusted accordingly.

**Quizzes:** There will be a weekly quiz given each Friday in the last 15 minutes of class. These will consist of one or two simple problems taken from the reading, HW and lecture from the previous week. The quizzes are given to provide you with feedback not to punish you. I will drop you lowest two quizzes at the end of the semester and your total % will be normalized to 100 points.

- Missed quizzes or exams (if excused) will be prorated-not made up.
- Missed classes before breaks or holidays because of travel plans are NOT excused absences!
- You may use a pencil or pen on quizzes and exams, however, if you use a pencil there is no re-grading of any part of your exam.
- Attendance will not be taken, however I often see that a student’s grade drops a letter for every 3 missed lectures…

**Homework:** Homework assignments will be handed out in class on a weekly basis. (Posted online as well) These will not be collected. It is your responsibility to keep up with the problem sets; procrastination will harm your progress in the course. I will post the keys online at the end of each week. It is imperative that you work these problems in order to maximize learning of the material. You may work together but beware; there is danger in relying too much on the help of others. I suggest you consult additional resources such as the LIBRARY and the internet in addition to your text.
Take Home Assignments: Over the course of the semester, I will assign several “take home” assignments. These are to be work independent of others. I will total these scores and normalize to a total of 50 points.

Final Exam: The final exam is comprehensive. No one may pass the course without taking the final.

Grading Scheme:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exams</td>
<td>300</td>
</tr>
<tr>
<td>Quizzes</td>
<td>100</td>
</tr>
<tr>
<td>Take Home assn.</td>
<td>50</td>
</tr>
<tr>
<td>Final Exam</td>
<td>150</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>600</strong></td>
</tr>
</tbody>
</table>

Grading Scale: (subject to adjustment)

- A to A- 100 to 88.5%
- B+ to B- 88.4 to 77.5%
- C to C- 77.4 to 66.5%
- D 66.4 to 50%
- F below 50%

DO NOT ASK ME TO “CURVE”, YOU DO NOT WANT THAT!

Exam Dates:

- Exam 1: 2/24/06
- Exam 2: 4/7/06
- Exam 1: 5/5/06

Final Exam: Wed., May 17 8:00 a.m. - 10:00 a.m.

Disabilities: If you have a disability and require accommodations, you need to provide disability documentation to SSWD, Lassen Hall 1008.

I suggest that you reacquaint yourself with your general chemistry text by reviewing the following topics:

- Chemical nomenclature
- Reduction and Oxidation
- Thermochemistry and Thermodynamics
- Kinetics
- Atomic Structure
Lecture Topics: We will try to cover the following topics… I will give weekly updates to the reading each week in class.

Calculus: (1 or 2 lectures)
Review of derivatives, partial derivatives and Integrals. Exact and inexact differentials

Thermodynamics
Chapter 2: The 1st Law (~3 lectures)
A. Energy conservation
B. The state of a system
C. Phase changes & chemical reactions
D. The molecular view of energy and enthalpy

Chapter 3: The 2nd Law (~3 lectures)
C. The heat engine: Carnot cycle
D. Entropy
E. The 3rd law
F. Gibbs free energy
G. The Helholtz energy
H. Partial derivatives in thermodynamics
I. Temp dependence on reaction enthalpies.

Chapter 4: Free Energy and Chemical Equilibria (~4 lectures)
A. Chemical potential energy
B. Reactions of gasses: The Ideal Gas Law
C. The Equilibrium Constant & The Gibbs free energy
D. Electrochemical cells
E. Biochemical applications of Thermodynamics

Chapter 5: Free Energy and Physical Equilibria (~3 lectures)
A. Phase Equilibrium
B. Colligative Properties
C. Molecular Wt. Determination

Chapter 6: Molecular Motion (~2 lectures)
A. Kinetic molecular theory
B. Molecular collisions and diffusion
C. Applications to macromolecules

Chapter 7-8: Kinetics: Rates of chemical reactions (~7 lectures)
A. Rates of reactions and reaction order, rate constants, integrated rate laws
B. Graphical treatment of rate data
C. Temperature dependence of rate constants, Arrhenius plots,
D. Mechanisms vs. Rate law, rate determining steps, Steady state approximation.

Enzyme Kinetics
A. Michaelis – Menten mechanism
B. Inhibitors
Chapter 9: Molecular Structure: Quantum Chemistry (~ 5 lectures)
   A. Foundations of Quantum Mechanics
   B. Schrödinger’s equation
   C. Quantum mechanical postulates
   D. Particle in a box and harmonic oscillator
   E. Solution to hydrogen atom
   F. Q.M. of small molecules and molecular orbital theory.

Chapter 10: Molecular Structure: Spectroscopy (~ 4 lectures)
   A. Electromagnetic Spectrum
   B. Absorption and Emission of Radiation
   C. Electronic Spectroscopy: UV spectroscopy
   D. Fluorescence
   E. Rotational-Vibrational Spectroscopy
   F. NMR