Chem 30322—Physical Chemistry II Section 2—Spring 2014

Instructors:

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Lecture:

T&Th 9:30–10:30
109 Pasquerilla Center

Office Hours:

By Appointment

Textbooks:

Physical Chemistry: A Moleculr Approach, by Donald A. McQuarrie and John D. Simon, ISBN: 0935702997

Grade:

Homework (weekly):	25%
Midterm 1:	22.5%
Midterm 2:	22.5%
Final (Cumulative):	30%
Extra Credit:	10%

After each exam you will be provided with a cumulative letter grade to keep you informed of your performance in the course.

Exams:

Midterm 1:	Thursday, February 20, 2014
Midterm 2:	Thursday, March 20, 2014
Final Exam:	Tuesday, May 6, 2014 (4:15–6:15 PM)

For each midterm exam you will be allowed to prepare and use one 8.5×11 sheet of notes (front-side only). On the final exam, three pages will be allowed. In addition, you will be allowed to use a calculator on all exams. The midterm exams will not be cumulative, but the final exam will cover material from the entire course.

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Problem Sets:

Approximately ten problem sets with Thursday due dates will be assigned. Collaboration is encouraged; however, *before* collaborating with your classmates, you should make an honest and *significant effort* to work through each problem on your own, and the problems set solutions must be written-up individually. Do not copy or paraphrase anyone else's work without giving proper credit. The use of online homework solution services (e.g. cramster) will be considered a violation of the Honor code.

A note about Extra Credit: Problem sets may contain one or more "extra credit" problems which are somewhat more difficult than the others. Extra credit points are explicitly off the curve to encourage collaborative problem solving on these problems. By doing these harder, optional problems, you can earn enough extra credit during the semester to increase your score by a full letter grade.

Problem Set Late Policy: Problem sets are due by 5:00 PM on Thursday. A problem set that is turned in before the following Wednesday at 5:00 PM will receive half-credit. Problem sets will not be accepted after 5:00 PM on the Wednesday following its original due date. In addition, each student will receive one "no questions asked" extension during the semester, whereby you may turn a problem set in by Monday at 5:00 PM for full-credit.

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Approximate Course Outline (some reordering will definitely take place):

I. Statistical Mechanics: The Bridge between microscopic and macroscopic behavior
II. Basic properties of Gases (Chapter 16)
    I. Ideal Gases
    II. Two-parameter Equations of State
    III. Virial Coefficients
    IV. van der Waals interactions and Molecular Potentials
III. The Boltzmann Factor (Chapter 17)
    I. Partition Functions
    II. Average Energies
    III. Physical properties and their relation to Partition Functions
IV. Partition Functions and Ideal Gases (Chapter 18)
    I. Translational Partition Functions
    II. Electronic Partition Functions
    III. Vibrational Partition Functions
    IV. Rotational Partition Functions
V. Math Review (Math Chapter H) - Partial Differentiation
VI. The First law of Thermodynamics (Chapter 19)
    I. Work
    II. Heat
    III. State Functions
    IV. Adiabatic processes
    V. Enthalpy
    VI. Heat Capacity
VII. Math Review (Math Chapter J) - Stirling's Approximation
    I. Entropy and The Second Law (Chapter 20)
    II. Energy is not enough!
    III. There's no such thing as a free lunch.
    IV. The Boltzmann Equation (what do you want on your tombstone?)
    V. The Third Law (Chapter 21)
VIII. Phase Equilibria (Chapter 23) and Chemical Equilibria (Chapter 26)
    I. Phase Diagrams
    II. Chemical Potentials
    III. The Clausius-Clapeyron Equation
    IV. Equilibrium constants and the Gibbs Free Energy
    V. Temperature dependence and the Van't Hoff Equation
IX. The Kinetic Theory of Gases (Chapter 27)
    I. Temperature as a measure of Kinetic Energy
    II. The Maxwell-Boltzmann distribution for molecular speeds
    III. The Mean Free Path and Collision frequencies
    IV. Diffusion
X. Chemical Kinetics (Chapters 28 & 29)
    I. Time Dependence and Rate Laws
    II. Orders of Reactions
    III. Reaction Mechanisms
    IV. Detailed Balance
    V. The Steady-State Approximation
    VI. Unimolecular reactions and the Lindemann Mechanism
    VII. The Michaelis-Menten Mechanism for Enzyme Catalysis
    VIII. Temperature dependence of Rate Constants
XI. Statistical Mechanics and Kinetic Theories
    I. Potential Energy Surfaces
    II. Transition State Theory
    III. Variational TST
    IV. "Early"- and "Late"-barrier reactions