Physical Chemistry II (CHEM 302)
Spring 2005
Lecture: Tu, Th 10:00AM to 11:15, DH-438
Discussion: Tu 11:30AM to 12:20, FH-105

Instructor: Jan Florian
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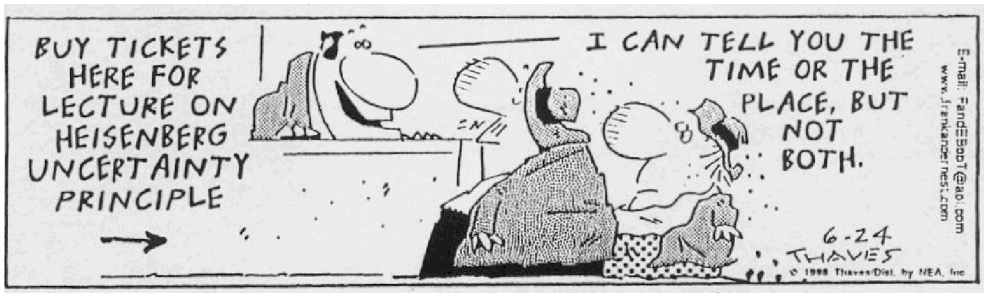

"Classical Physics did an excellent job accounting for large aggregate states – for the familiar reality that we experience in our everyday lives – but failed to describe the underlying properties of matter and radiation on the atomic level. Quantum Mechanics is an effort to describe this strange yet compelling world in which things are not what they seem to be."

-Cass Sacket

"Chemistry is essentially about bonding of atoms to form molecules. Since a chemical bond is a purely quantum phenomenon, this alone underscores the importance of quantum mechanics to chemistry."

-from Physical Chemistry, Keith Laidler, John Meiser, and Brian Sanctuary

Course Layout and Objectives

Part 1: Quantum Mechanics and Atomic Structure
1. Understand the basic concepts of quantum mechanics and underlying mathematics
2. Apply quantum mechanics to the study of atomic structure
Part 2: The Chemical Bond
3. Apply quantum mechanics to the study of molecular structure
Part 3: Foundations of Chemical Spectroscopy
4. Understand how light interacts with matter on the molecular level
5. Understand the relationship between quantum mechanics and spectroscopy.
Part 4: Chemical Kinetics and Statistical Mechanics
6. Understand relationships between microscopic and macroscopic properties of chemical systems.

Grading: The grading of the course will consist homework, weekly quizzes, a midterm exam and a final examination. The weighting of the examinations for the final grade in the course is as follows:

Homework	20%
Quizzes	20%
Midterm Examination	20%
Final Examination (cumulative)	35%
Active participation	5%

The following grading scale will be used in the determination of grades. A = 90 -100%, A- = 85 - 90%, B+ = 80 - 85%, B = 75 - 80%, B- = 70 – 75%, C+=65 - 70%, C= 60 – 65%, C- = 55 – 60%, D+=50 - 55%, D=45 - 50%, F= below 45%. In order for a student to get grades A or A- in the class, he/she must get at least half of homework points.

Homework Policy: Homeworks will be assigned at Th class and due at the beginning of the next Lecture (Tue). Late homework receives grade 0.

Quizzes: Short test will be given every 2 weeks at the beginning of the Tue class.

Course Outline and Reading Assignments: It is important to come to class prepared by reading (and thinking about) appropriate material in the textbook because it is impossible to cover all of the necessary details involved in learning quantum chemistry during the lecture. I hope to be a useful facilitator in your quest to learn the material, but ultimately, the responsibility for learning the material is yours.

Textbook: R. J. Silbey, R. A. Alberty, M. G. Bawendi, Physical Chemistry, 4th Ed., John Wiley & Sons, Inc., 2005.

Recommended books: Solutions Manual
Applied Mathematics for Physical Chemistry 3rd ed. by James R. Barrante

Week	Reading/Lecture	
1st	Ch. 9	What is classical physics and where it fails. Trigonometry, Logarithms. Complex numbers, Differential and Integral Calculus, Operators.
2nd	Ch. 9	Quantum mechanical postulates. Hamiltonian. Wavefunction. Boundary conditions.
3th	Ch. 9	Schrodinger equation. Particle in a box. Degeneracy. Uncertainty Principle.
4th	Ch. 9	Harmonic oscillator. Tunneling.
5th	Ch. 10	Atoms. Spin. Approximate methods of solving Schrödinger equation
6th	Ch. 11	Born-Oppenheimer Approximation. Valence Bond Theory. Molecular orbitals.
7th	Ch 11	Matrices. Huckel Theory. **Midterm Exam** (exact date/time will be announced in the class).
8th	Ch 11, 13	Intermolecular Forces. Molecular vibrations.
9th	Ch 12	Symmetry elements. Point groups.
10th	Ch 13	Introduction to Spectroscopy. Rotational and vibrational spectra.
11th	Ch 14	Electronic spectra of molecules. Beer's law. CD spectra.
12th	Ch 14	Laser spectroscopy. Fluorescence. Photoelectron spectroscopy.
13th	Ch 15	NMR Spectrocopy.
14th	Ch 16	Introduction to Statistical Mechanics.
15th	Ch 18	Introduction to chemical kinetics. Transition state theory.
Final Exam		**1 MAY 07, 1:00-3:00 pm**