Chemistry 410A: Physical Chemistry — Course Syllabus

Fall 2014, Mon, Wed, & Fri 12:00 to 12:50 , GMCS–314

Instructor Dr. David Pullman, CSL–301, 619–594–5573, dpullman@mail.sdsu.edu

Office Hours Mon, Wed 4:00–5:00; Tues 1:00-2:00

Textbook *Physical Chemistry, 10th Ed.*, P.W. Atkins and J. de Paula

Prerequisites Chemistry 232, 232L, 251; Mathematics 252 (Mathematics 150, 151; 252 or Physics 195, 195L, 196, 196L for chemistry teaching major); Physics 195, 195L and 196, 196L. Recommended: Physics 197 and 197L

Catalog Description Theoretical principles of chemistry with emphasis on mathematical relations. Theory and practice in acquisition and statistical analysis of physical measurements on chemical systems.

Course Overview The focus of the lecture potion of Chem 410A is on Quantum Mechanics and its main application, spectroscopy. After developing the basic principles of Quantum Mechanics to describe the translational, vibrational, and rotational motion of particles, we will extend our knowledge to understand the motion of electrons and nuclei in atoms and molecules. This knowledge of atomic and molecular properties will lead in a natural way to a discussion of various types of spectroscopy (including rotational, vibrational, electronic, and nuclear magnetic resonance spectroscopy), which are key techniques in modern science for analyzing chemical samples.

The computer lab portion of Chem 410A is designed to reinforce some of the concepts from the lecture and to introduce additional topics, such as error analysis and curve fitting, which are important in the analysis of scientific data. You will use Microsoft Excel, Maple, and Gaussian to carry out the scientific calculations. Further details are given in the lab manual, available in the bookstore.

Topics The two topics we will cover in Chem 410A are Quantum Mechanics and spectroscopy.

Quantum Mechanics	Chap 7 Introduction to Quantum Theory
	Chap 8 The Quantum Theory of Motion
	Chap 9 Atomic Structure and Spectra
	Chap 10 Molecular Structure
Spectroscopy	Chap 12 Rotational and Vibrational Spectra
	Chap 13 Electronic Transitions
	Chap 14 Magnetic Resonance

Course Structure Chem 410A consists of three hour-long lectures each week in addition to a three hour computer lab each week. The lectures will roughly follow the text, with additional material occasionally added.

Exams

Exam 1 Tentatively chapters 7, 8
Exam 2 Tentatively chapters 9,10
Exam 3 Tentatively chapters 12,13
Final Tentatively chap 14 and cumulative Wed Dec 17, 10:30–12:30

- No makeup exams will be given.
- Dedicated calculators may be used during exams; cell phones and other electronic gadgets, such as ipods and ipads, must be turned off before the start of exams.

Problem Sets

There will be one or two problem sets per chapter. Problem sets will ***not*** be graded; you do not need to hand them in. You can download them from the Blackboard website for Chem 410A. **Doing the problem sets is of the utmost importance to learning the material and doing well on exams**.

The **BAD,** but easy, way to do a problem is to look at the solution while you think about the problem. Nearly as bad is to think about a problem for five minutes, give up, and then look at the solution key. You are doing yourself a substantial disservice if you approach the problem sets in this fashion.

The **GOOD**, but more difficult, way is to focus your energy on a problem for a sustained period (say 30 minutes or longer). If you can't answer the problem, go on to another problem— but do not look at the answer key if it is already available. Later on, after you have done other problems, things may gel in your mind, and you may see how you should approach the problem. Real learning involves, among other things, recognizing patterns in problems and comes only after a significant effort on the part of your brain.

Grading

Exams	16% each	⎫
Final	27%	⎬ Lecture part of 410A = 75%
Computer Lab	25%	

Final grades, +/– grading and curved scale will be used.

Student Learning Outcomes

Upon completing Chem 410A, students will be able to:

1. Understand and articulate the basic principles of Quantum Mechanics, as well as the differences between Classical and Quantum Mechanics
2. Use the fundamental model systems of Quantum Mechanics to calculate or estimate properties of real atoms and molecules
3. Understand how Quantum Mechanics enables one to interpret atomic and molecular spectra in terms of the energies and motions of atoms and molecules
4. Perform scientific calculations and simulations using Excel, Maple, and Gaussian

Add/Drop Procedure

The add/drop deadline is Sept. 8, 2014. For details, see http://arweb.sdsu.edu/es/registrar/schedule_adjustment.html

Students with Disabilities

If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that accommodations based upon disability cannot be provided until you have presented your instructor with an accommodation letter from Student Disability Services. Your cooperation is appreciated.