

Che 432, Phy 532: Physical Chemistry II
Spring 2007, 3 credits

Class times: MWF 10:20-11:10, Bowers 151

Instructor: Dr. James Ayers, Bowers 49
758-5317, ayersj@cortland.edu

Office Hours: MWF 9:30-10:20
or by appointment

Course Description

Chemistry 432 is the second semester of a two-semester series covering physical chemistry. In this semester, we will focus on quantum mechanics and spectroscopy.

Prerequisites:

Chemistry 431. We will do more calculus this semester than last semester, mostly solving simple differential equations. Differential equations is not a required prerequisite; however, a strong calculus background is essential. We may have outside calculus help sessions and homework problem sessions if there is a need or desire for them.

Textbook

Physical Chemistry, Engel and Reid, 1st edition (Pearson Benjamin Cummings, 2005).

Course Structure

Most instruction will be in the lecture format, although sometimes we will have group discussions.

Homework: twelve weekly assignments. Assignments will usually be due one week from handout date. Only six assignments will be collected and graded.

Quizzes: six in-class quizzes, usually on Fridays. Quizzes will be given on weeks when homework is not handed in (see schedule).

Midterms: There will be two midterm exams, given on 28 February (Wednesday) and 6 April (Friday). Midterms will be given during class time and will last 50 minutes.

Final: The final exam will be Friday, 11 May from 1:00 to 3:00 PM. It will be comprehensive, covering about 50% from after exam 2 and 50% from the whole course.

What you will learn

We will begin with quantum mechanics, setting a firm theoretical framework for what we briefly introduced last semester. We will cover several of the “classic” problems from quantum mechanics: particle in a box, the harmonic oscillator, particle on a sphere, rigid rotator, and the hydrogen atom. We will then transition into spectroscopy, discussing how molecules absorb light and how we can use this absorption to learn about molecules.

Problem sets and Quizzes

The best way to learn physical chemistry is by practicing! This is why homework is so important to your success in this course. I will collect and grade 6 of the 12 homework assignments. You will be graded on both the final answer you give and the thought process used to arrive at the answer; therefore, it is vital that you show your work carefully. If you are unsure if you’ve shown enough work, use the following guideline: if you find your old assignment one year after turning it in, you should be able to follow

your solution without having to dig out your books or old notes. Homework will be due at 5 PM on the due date in my office/under my door, although you are welcome to turn it in during class. Late homework may be handed in the following Monday for a 50% reduction in grade; homework received later will not be graded.

During the six weeks that homework is not collected, there will be a short quiz during the first third of the class period. Quizzes are closed-book, closed-note (calculator allowed). Necessary equations will be provided on the quiz. Material for the quizzes will come from the lectures and will consist mainly of material that was covered in the corresponding homework assignment.

Policy on homework collaboration

Homework assignments may be long or difficult, and collaboration can be a great way to improve your understanding of the material. Because of this deeper understanding gained by working in groups, collaboration is encouraged. Please follow these guidelines if you choose to work in groups.

1. You may work together in *small* groups (not greater than three people) to discuss approaches and solutions to the homework problems.
2. You may **NOT** copy line-by-line someone else's solutions, and you may **NOT** allow someone else to copy your work.
3. You must understand the problem solutions well enough so that you could rework the problem in its entirety on your own.

No collaboration is allowed on in-class quizzes and exams!!

Policies on Exams

There will be two midterms and one final this semester. Exams will cover all material in the lectures, assigned readings, and homework assignments. Stress will be on topics that are covered thoroughly in more than one of these media. Exam questions will include short-answer conceptual questions, mechanical "plug-and-chug" problems, and more difficult multi-step problems. The exams will emphasize understanding a few principles and applying them rather than memorizing multiple equations. An equation sheet will be provided with all formulas essential to solving the problems posed on an exam. Exams will be closed book, closed notes. However, you will be allowed to bring a 1 page of formulas (front side only) into each midterm and a full sheet into the final. You will be required to turn these sheets in with your exam.

Exam times are announced now to allow plenty of time for you to plan enough time to study for and attend the exam. Although the times are chosen to avoid conflicts, conflicts for university-sponsored activities will be considered as long as I am notified at least two weeks before the exam date. If there is a conflict with taking the exam at the time given, let me know as soon as possible, and I will try to make arrangements. If an emergency circumstance prevents you from taking an exam, please notify me as soon as possible, and I will make every attempt to make alternate arrangements.

Evaluation

Final course grades will be assigned weighing the individual factors in the following way:

Quiz & HW	150 pts	30%
Exam I	100 pts	20%
Exam II	100 pts	20%
Final	150 pts	30%

Each homework and quiz will be graded out of 10 points. Out of the twelve homework assignments and quizzes, your lowest two grades will be dropped.

The base grading scale is as follows:

A	>90%
B	80-90%
C	70-80%
D	60-70%
E	<60%

The dividing lines between letter grades will not be changed upward; however, they may be moved to lower percentages, depending on the overall course performance.

Summary of available resources

In addition to the textbook, the course website (announced later) will have solutions to problem sets, quizzes, and exams posted, along with any handouts.

Another standard text for the subject is *Physical Chemistry* by Atkins and de Paula (older versions are just Atkins). I will not use or follow this text explicitly, but it often presents another view of the course material that may be useful. I have a copy in my office that I will lend out if you'd like. There are other good books (almost all by the name physical chemistry) in the library.

Please come by office hours, email me, or call me if you have any concerns at anytime throughout the semester.

Students with Disabilities

If you are a student with a disability and wish to request accommodations, please contact the Office of Student Disability Services located in B-1 Van Hoesen Hall or call (607) 753-2066 for an appointment. Information regarding your disability will be treated in a confidential manner. Because many accommodations require early planning, requests for accommodations should be made as early as possible

Course Material Outline (VERY ROUGH AND PROBABLY WILL CHANGE!)

- 1 Introduction; nature of an electron; failures of classical mechanics (E&R 12)
- 2 Waves and an introduction to the Schrodinger equation (E&R 13.2-13.7)
- 3 The postulates of quantum mechanics (E&R 14)
- 4 Particle in a Box with applications, Heisenberg uncertainty, tunneling (E&R 15, 16.2, 16.3, 16.5, 16.8, 17.3)
- 5 The harmonic oscillator (E&R 18.1), **EXAM 1**
- 6 Introduction to QM in 3D (E&R 18.2-18.5)
- 7 Rovibrational spectroscopy (E&R 19.1-19.6)

SPRING BREAK

- 8 The Hydrogen atom (E&R 20.1-20.4)
- 9 More on H-atom, exam (E&R 20.5-20.6)
- 10 Complex atoms and atomic spectroscopy (E&R 21.1-21.3), **EXAM 2**
- 11 Continue complex atoms (E&R 21.4-21.8, 22.1, 22.2)
- 12 Diatomic molecules (E&R 23.1-23.5, 24.1-24.5, 24.7), Scholar's day
- 13 Molecules and symmetry (E&R 28)
- 14 Spectroscopy of molecules (E&R 26.1, 26.3, 26.6-26.8)
- 15 Electronic spectroscopy

Tentative course schedule**January**

S	M	T	W	Th	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22 1st Class Day	23	24	25	26 PS 1 due	27
28	29	30	31			

February

S	M	T	W	Th	F	S
				1	2 Quiz 2	3
4	5	6	7	8	9 PS 3 due	10
11	12	13	14	15	16 Quiz 4	17
18	19	20	21	22	23 PS 5 due	24
25	26	27	28 EXAM 1			

March

S	M	T	W	Th	F	S
				1	2	3
4	5	6	7	8	9 Quiz 6	10
11	12 SPR BREAK	13 SPR BREAK	14 SPR BREAK	15 SPR BREAK	16 SPR BREAK	17
18	19	20	21	22	23 PS 7 due	24
25	26	27	28	29	30 Quiz 8	31

April

S	M	T	W	Th	F	S
1	2	3	4	5	6 Exam 2	7
8	9	10	11	12	13 PS 9 due	14
15	16	17	18 SCH DAY	19	20 Quiz 10	21
22	23	24	25	26	27 PS 11 due	28
29	30					

May

S	M	T	W	Th	F	S
		1	2	3	4 Quiz 12	5
6	7 Last Class Day	8	9	10	11 FINAL 1:00 PM	12