

Instructor	Prof. William R. Simpson
Office	NSF 186 and IARC 335, Office: 474-7235 Lab: 474-2436
Email	wrsimpson@alaska.edu
Class meeting	Monday, Wednesday, and Friday 10:30 - 11:30 AM, REIC 165
Laboratory Section	Tuesday, 11:30 – 2:30 PM, REIC 245 (sometimes in Chemistry computer lab, REIC 172)
Office hours	Mon, Fri 11:30AM—12:30PM, Tu 10:30-11:30AM, and by appointment
Text	“Physical Chemistry” by Atkins and de Paula, 9 th edition Handouts for laboratory section

Course Description (from catalog): Atomic and molecular structure, and spectroscopy, and statistical mechanics. Course teaches these concepts using both lecture and laboratory instruction. Special fees apply. Prerequisites: CHEM F331; MATH F253X; or permission of instructor. (3+3)

Course Goal: Chemistry 332 is the second semester of a two-semester series in physical chemistry. Our goal is to understand how physical and mathematical theories can be used to explain chemical behavior.

Learning Outcomes: In this semester, you will study quantum mechanics with applications in atomic and molecular structure, spectroscopy, and statistical mechanics. At the end of the course, you should have gained new mathematical methods for solving chemical problems, and learned advanced concepts that allow you to understand chemical behavior from a quantum mechanical basis.

Course structure: The course follows your text in the order described on the attached schedule of topics. During Monday and Wednesday classes, I will lecture on the material in the book. Reading the book before the lectures will be important for following and understanding the lectures. The Friday classes are a combination of lecture and in-class quizzes. These Friday quizzes are a very important part of the course as they will help you to stay current with and to understand the material of the course. The course also has a laboratory section to give physical examples of the concepts you learn in class.

Grading Structure (points): Your course grade will be based on the total points of the hour exams, the final exam, the quiz scores, reading feedback, laboratory (see below), and possibly extra credit from reading feedback (see below). Material assigned in readings, in lecture, in laboratory, or in homework problems may appear on an exam. The maximum number of points for each is given below:

Exercise	Points
Hour exams 100 pts each	300
Final exam	100
Quizzes	80
Reading feedback	20
Laboratory	150
Total	650
Extra credit: Reading feedback	+10

Exams: The exams will be given during class, and will be one hour in length. You are permitted to use a calculator, a unit sheet (distributed with the exams), and a half sheet of paper (8.5"x5.5") containing only formulas. You should continually prepare this sheet as you study the material.

Don't copy your friend's sheet. Preparing and organizing material is essential. I will look at the sheet during the exam and may collect the sheet. Chemistry Department regulations require that any student caught cheating on graded work will be assigned a course grade of F. Course drop forms will not be signed in these cases. Homework, quiz, and exam solutions will be **posted on the web in the Blackboard system**.

Make up exams: Make-up exams will be allowed if you have a good reason. If you anticipate an absence (work commitments, intercollegiate sports), talk to me **before** the exam to make arrangements. If the absence is unexpected (illness, family or personal difficulties), *talk with me at the earliest possible opportunity*.

Support Services: Students with documented disabilities who may need reasonable academic accommodations should discuss these with me during the first two weeks of class. You will need to provide documentation of your disability to the UAF Office of Disability Services at 208 Whittaker, 474-5655, TTY 474-1827, uaf-disabilityservices@alaska.edu, or through www.uaf.edu/disability.

Syllabus Revision: Before the drop date, I may slightly revise the syllabus to correct errors that are found. Revision at a later time would require approval by all students in the class at that time. A revised copy of the syllabus will be distributed to all students and posted to Blackboard. Adjustments to the tentative lecture pacing and/or laboratory order below can be made by the instructor to best optimize use of class / lab time and will be communicated to students via Blackboard and email.

Homework: Physical chemistry is a hard class. I see three ways that the class is hard: 1) Mechanically: It can be hard to calculate the correct answer because of algebra complexities or unit conversions. Some of your homework problems are designed to hone these skills. A solid mathematics background also helps. 2) Conceptually: You will have to find the right technique to solve a problem or identify the formula appropriate for the problem. 3) Theoretically: Many of the central concepts of physical chemistry reappear throughout the class. Therefore, seeing parallels between what at first appear to be different problems assists you in mastering the material of physical chemistry. This is the true power of physical chemistry. For example, in general chemistry, you learned about equilibrium constants and also about vapor pressures of gases. In this class, you will discover that both processes are described by the same theory.

Homework and in-class quizzes are critical aspects of learning these three parts of physical chemistry. Every week you will be assigned 3 to 6 homework exercises. These homework exercises are not graded, but you will be provided with homework keys (posted on the web). If you attempt a problem but don't get an answer, see me for help. A few of these exercises are selected to improve your mechanical skills and also help you to find the right formula to apply to a problem. Many of the problems will be conceptual in nature. These questions address the theoretical connections between various physical chemistry problems.

Quizzes: The quizzes will be given during class, and will be about 15 minutes in length. You are permitted to use a calculator, and a formula / unit sheet (distributed with the quiz). The formula / unit sheet will have all appropriate formulae as well as numerical values for constants and unit conversions. The quizzes will be on all Fridays except on the Friday during the week of an hour exam (see exam dates below). The purpose of the quiz is to provide a frequent check on learning progress. Doing the homework diligently is the best way to assure good grades on the quizzes, and past experience has shown that good quiz grades translate to good course grades. There will be no makeup quizzes, but your two lowest quiz grades will be dropped. Answers to the quizzes will be posted on the website.

Working in groups: While working on your homework and/or preparation for Friday quizzes, you may work in groups. In fact, working in groups usually results in faster and deeper learning. Whether you work in a group or alone, you must take the exams and quizzes alone. Copying the solution of another student is not working in a group and will lead to a hole in your understanding that will appear in your exam and quiz performance. My advice is to work the homework and study in groups but don't cheat yourself.

Reading Assignments and Reading Feedback: I will assign the reading (on the order of 10 pages) for the next class through the blackboard web system within a couple hours of completion of a class. Doing this reading as preparation for the class is critical to being able to follow the material in the class, and allows the lecture to reinforce your reading. Following the lecture, the problem sets then further the learning, and the weekly quiz provides frequent checks. At most classes, I will collect brief (2-sentence) feedback on the reading that you completed in preparation for the class. **I specifically want to know what was clear or confusing in the reading; simply write 1-2 sentences in this regard.** There will be 30 of these feedback writeups, each graded as one point. Twenty of these points will count towards the normal point total, and up to 10 points will be extra credit to reward you for careful reading of the book. Therefore, I list 20 points as in the normal points and 10 points of extra credit for the total 30 points of reading feedback.

Laboratories: As a part of this course, we will carry out a set laboratory experiments that will help you to see physical examples of the concepts you are learning in class. The laboratory experiments are graded on participation in the laboratory, your laboratory notebook, completion of pre- and post-lab work (when applicable), and brief written laboratory reports assigned as a part of the post-lab work.

The exams will be given on the following dates: see the calendar for more detailed information. Exams are generally on Wednesday, and quizzes are on Friday.

Exam	Material Included	Date
1	Weeks 0-3	10 Feb (Wed)
2	Weeks 4-7	9 Mar (Wed)
3	Weeks 8-10	6 Apr (Wed)
Final	60% Weeks 11-15, 40% cumulative	3 May (Tues)

Tentative Grade Scale (If you get at least 90%, you are guaranteed an "A". I may elect to set the grade cutoffs lower, but we will not set them higher.) I will not be using +/- grading.

Grade	Percentage
A	90 %
B	80 %
C	70 %
D	60 %

Important dates:

Alaska Civil Rights Day (MLK birthday, holiday) Monday, 18 Jan
 Last day for drops (course does not appear) and 100% tuition+fee refund .. Friday, 29 Jan
 Spring Break (holiday) Monday - Friday, 14-18 Mar
 Last day for withdrawals (W appears on academic record) Friday, 25 Mar
 Springfest (holiday) Friday, 22 Apr
 Final Exam (10:15-12:15) Tuesday, 3 May

Summary of Resources:

Faculty—Bill Simpson, NSF 186, 474-7235, wrsimpson@alaska.edu

Chem332 home page: log into the blackboard system: <http://classes.uaf.edu/> —syllabus, sample exams and solutions, solutions to quizzes, homework solutions, email to faculty, links to other sites.

Tentative Schedule of topics (see blackboard website for detailed reading assignments):

Week	Dates	Chapter	Topic
0	15 Jan	----	Introduction to Physical Chemistry II
1	*-20-22 Jan	7	Quantum Theory – Schroedinger equation
2	25-29 Jan	7	Quantum Postulates / Simple systems
3	1-5 Feb	8	Particle in the box and harmonic oscillator
4	8-* -12 Feb	8,9	Harmonic oscillator, rotation, H atom
5	15-19 Feb	9	Hydrogen atom / multi-electron atoms
6	22-26 Feb	9,10	Atomic (electronic) spectroscopy
7	29 Feb-4 Mar	10	Multi electron atoms and diatomic bonding
8	7-* -11 Mar	10,11	Molecular Orbital theory and polyatomics and molecular symmetry introduction
----	14-18 Mar	----	Spring Break – No classes
9	21-25 Mar	11	Molecular symmetry
10	28 Mar-1 Apr	12	Rotation-vibration of diatomics
11	4-* -8 Apr	12, 13	Rotation-vibration of polyatomics, electronic spectra
12	11-15 Apr	13	Electronic spectroscopy / computational chemistry
13	18-20-* Apr	15	Probability / Boltzmann distribution
14	25-29 Apr	16	Statistical mechanics
15	2-* May		Review for final

* = short week, holiday on one day of the week, or exam that week

Tentative schedule of laboratories (see blackboard website for details / handouts):

Lab#	Date	Topic
1	26 Jan	Introduction to lab and safety
2	2 Feb	Computational Chemistry: Introduction
3	9 Feb	Particle in a box: Spectra of long conjugated molecules
4	16 Feb	The Spectrum of a One-Electron Atom: Hydrogen
5	23 Feb	Spectra of multi-electron atoms: Helium
6	1 Mar	Comp. Chemistry: Electronic potential energy curves
7	8 Mar	Electronic structure calculations: Conjugated pi systems
----	15 Mar	Spring Break – No Lab
8	22 Mar	The Spectrum of Conjugated pi systems
9	29 Mar	The Rotation-Vibration Spectra of diatomic molecules
10	5 Apr	Polyatomic spectroscopy: CHCl ₃ vibrations
11	12 Apr	Iodine Electronic spectroscopy and analysis
12	19 Apr	Fluorescence of polyatomic aromatic hydrocarbons
13	26 Apr	Computational Chemistry: Statistical mechanics