Syllabus

Spring 2017

CHE 356: Physical Chemistry Lecture

Section M001, 3 credits Lectures TTh 11-12:20

Professor Joe Chaiken (jchaiken@syr.edu)

Office: 2-010 CST, Phone 443-4285

Office hours: 1-2pm Monday or by appt.

Textbooks: *Physical Chemistry*, 3rd Edition; Engel and Reid, (Pearson, 2013).
Chemistry Secretary: Elizabeth Molloy, 1-014 CST, 443-2851, eemolloy@syr.edu

Course Description: CHE 356 is the second semester of the two-semester physical chemistry sequence intended for undergraduates majoring in various science and engineering disciplines. In this semester we explore the basic ideas of quantum mechanics, spectroscopy, chemical bonding, statistical mechanics (review), chemical kinetics and perhaps a few more topics as time permits. Whereas thermodynamics requires no specific knowledge of the microscopic nature of matter and energy to achieve a quantitatively sound macroscopic picture of our universe, this semester we shall see that it is possible to achieve a sound *microscopic* picture of matter and energy. As you saw last semester, using the methods of statistical mechanics, all the thermodynamic quantities can be calculated from spectroscopic and other physical data. We will always pursue a quantitative approach in order to bolster our intuitive understanding of how the microscopic properties of atoms and molecules are manifest in the macroscopic properties and processes that characterize our world. The only chemistry prerequisite is successful completion of CHE 346 or the equivalent.

Assignments and Lectures: Although a specific book is stated above, the lectures will not necessarily follow the book's presentation as I will introduce some different subjects and leave out others. Readings, problems and exercises and lectures are *required*; you skip them at your own peril. **Struggling through problems is the only known pathway towards understanding and proficiency.** Doing problem sets almost every week will improve your grade. Although every effort will be expended to delineate the material of interest in the book, it is inevitable that exams will be based on materials from *both* the lecture and the book and their overlap may not be complete.

Students should do all assigned/recommended problems and then some. You need to be able to solve problems easily and quickly. What we know about the natural world has all come from the quantitative analysis and interpretation of reproducible experiments and observations. Problem set questions are often supposed to mimic such experiments and observations. You will learn some things this semester that will be useful for the rest of your careers although this may be the only time you will be exposed to them and given some opportunity to learn them in an organized fashion. Don't waste the opportunity. Going to the library (OMG! OK-the Internet…) and looking at various texts with alternate presentations of the same material is often useful.

In order to facilitate a friendly and possibly fun (lol) group learning environment we have chosen to continue an exercise we tried last year (more or less). At a few points of my choosing we will divide the students taking this course into an even number of groups, probably 10 groups. Each week, half of the groups will be tasked to produce 3 questions, 1 each of easy, medium, and high

degree of difficulty. There should be a grand total of 10 answers that need to be provided i.e. counting multiple parts for some questions for each problem set. The group that produces the questions must also produce the answer key. The TAs and I will examine the questions ***and*** the keys and all the students producing the questions/key will get the same grade for that week. The other 5 groups (if there are 10 groups total) will answer those questions and hand them in the following week, along with 3 new questions for the other 5 groups. Those students will get a grade based on their performance on the problem set their colleagues produced. The Groups will alternate in weeks as questioners and answerers. Probably the groups will be jumbled regularly to insure that the same groups are not always answering questions form the exact same groups. This will proceed most of the semester with the subject matter changing throughout. I will also put problems sets and keys from earlier versions of CHE 356 on Blackboard that will give students more practice and also some idea of what kinds of questions are appropriate. Mastering Chemistry will also be employed in an ad hoc manner as circumstances permit.

Office Hours: You are invited to visit me almost anytime although using the office hours noted above, or simply calling (443-2925) or emailing for an appointment, will insure that I am available when you arrive. I will be most effective when you come with specific questions.

Attendance and Quizzes: Unannounced quizzes may be given at any time. There are no make-up quizzes. **Because an email sent is not always an email received, advance notice for absences cannot ever be accepted by email.**

Teaching Assistants: contact information is below.
Elyse Kleist
emkleist@syr.edu
cell number: 717-798-2240
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Peter McLaughlin
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Grades and Examinations: There will be three hourly exams and a Final Exam. The hourlies will be given at the times below during regular class time. The lowest Hourly score will be dropped in the calculation of the final grade. There are no make-up exams and the Final Exam will not be dropped in any case. If a student fails to take one of the hourly exams and subsequently fails to take a second hourly exam, each for a valid documented in writing medical/emergency reason, the average of the remaining exams will be used for the missing exam grade to calculate the final grade. In the case of missed quizzes, they will be prorated similarly to the above and there will also be no make-up quizzes.

Tentative Exam Dates	
Tuesday, February 14	Exam 1
Tuesday, March 28	Exam 2
Tuesday, May 2	Exam 3

The Final Exam will be given 8:00AM - 10:00AM, Friday May 5, 2017 in CST 1-019.

Your grade will be computed *approximately* as indicated below:

Best 2 of exams 1, 2, and 3	50%	(equal weight)
Final Exam	40%	
Problem Sets/Quizzes/Etc.	10%	
	100%	

In class participation will be manifest in *very slight* shading for borderline cases - only upwards.

Syllabus Academic Integrity Statement

The Syracuse University Academic Integrity Policy holds students accountable for the integrity of the work they submit. Students should be familiar with the Policy and know that it is their responsibility to learn about instructor and general academic expectations with regard to proper citation of sources in written work. The policy also governs the integrity of work submitted in exams and assignments as well as the veracity of signatures on attendance sheets and other verifications of participation in class activities. Serious sanctions can result from academic dishonesty of any sort. For more information and the complete policy, see http://academicintegrity.syr.edu

Syllabus Statement Regarding Disability-Related Accommodations
Students who are in need of disability-related academic accommodations must register with the Office of Disability Services (ODS), 804 University Avenue, Room 309, 315-443-4498. Students with authorized disability-related accommodations should provide a current Accommodation Authorization Letter from ODS to the instructor and review those accommodations with the instructor. Accommodations, such as exam administration, are not provided retroactively; therefore, planning for accommodations as early as possible is necessary. For further information, see the ODS website, Office of Disability Services <http://disabilityservices.syr.edu>

CHE 356 Spring 2017
Approximate Lecture Schedule

The Table above lists the **approximate** topics that will be covered including dates and relevant readings. Each exam covers the all preceding Chapters including any new material. Copies of lecture notes will be put on Black Board.

Date	Lecture Topic	Reading
Tuesday, January 17	Syllabus, History	Chap 12
Thursday, January 19	Schrodinger Eqn., Postulates	Chap 13
Tuesday, January 24	Free Particle, Particle in Box	Chap 15
Thursday, January 26	Particle Box examples	Chap 16
Tuesday, January 31	Heisenberg Uncertainty	Chap 17
Thursday, February 2	Harmonic Osc. - Rigid Rotor	Chap 18
Tuesday, February 7	Vibrational Spectroscopy	Chap 19
Thursday, February 9	Rotational Spectroscopy	Chap 19
Tuesday, February 14	Exam 1	
Thursday, February 16	Hydrogen Atom	Chap 20
Tuesday, February 21	Many Electron Atoms	Chap 21
Thursday, February 23	Atomic Spectroscopy	Chap 22
Tuesday, February 28	Molecular Orbitals	Chap 23
Thursday, March 2	Bond Diagrams	Chap 24
Tuesday, March 7	Orbital Hybridization	Chap 24
Thursday, March 9	Hückel Theory	
Tues, March 14	No Class Spring Break	
Thurs, March 16	No Class Spring Break	
Tues, March 21	Elec. Abs. Spectroscopy	Chap 25
Thurs, March 23	Elec. Emiss. Spectroscopy	Chap 25
Tuesday, March 28	Exam 2	
Thursday, March 30	Stat. Mech. Probability	Chap 29
Tuesday, April 4	Boltzmann Distribution	Chap 30
Thursday, April 6	Partition Functions	Chap 31
Tuesday, April 11	Statistical Thermodynamics	Chap 32
Thursday, April 13	Kinetic theory of gases	Chap 33
Tuesday, April 18	Reaction rates	Chap 35
Thursday, April 20	Reaction mechanisms	Chap 35
Tuesday, April 25	Catalysis	Chap 36
Thursday, April 27	Photochemistry	Chap 36
Tuesday, May 2	Exam 3	