Chemistry 3A
CHEMICAL STRUCTURE AND REACTIVITY
UC Berkeley – Spring 2015
Dr. Pete Marsden – 323 Latimer – petermarsden@berkeley.edu

Location and time: 1 Pimentel: Tu and Th 8:00 - 9:30 AM and repeat 2:00 – 3:30 PM

General Information:

Chemistry 3A is the first semester of a two-semester survey of organic chemistry. The main learning goals for this course are 1) to understand and apply Coulomb's Law with respect to chemical reactions, 2) to qualitatively apply the concept of resonance to reactivity, and 3) to use the concepts of molecular orbital theory to understand and even predict the way certain reactions occur with respect to their three dimensional outcomes (stereochemistry) and multiple products (regiochemistry).

Course Website: http://bcourses.berkeley.edu

The course website will be used for announcements throughout the semester, as well as for periodically posting selected resources. You are responsible for checking the site on a regular basis. All homework will be posted under the Files tab. Exam and quiz grades will be posted under the Gradebook tab.

Email: petermarsden@berkeley.edu

All e-mail concerning Chemistry 3A should have "Chem3A" in the title. Use e-mail for asking simple questions about the course or if you would like to make an appointment to see me. Do not expect detailed answers to chemical questions since organic chemistry is a very visual science and generally requires structures to explain concepts. These questions are more appropriate for office hours.

Exams:

- Midterm Exam #1 will be held on Thursday, February 26 from 7:00 – 9:30 PM.
- Midterm Exam #2 will be held on Tuesday, April 14 from 7:00 – 9:30 PM.
- The Final Exam will be held on Wednesday, May 13 from 8:00 – 11:00 AM.

THERE WILL BE NO MAKE-UP EXAMS. ALL EXAMS ARE ONLY OFFERED AT THE SCHEDULED TIME.

Recommended Materials:

- K. P. C. Vollhardt, N. E. Schore; "Organic Chemistry, 7th Edition," Freeman, New York.
- N. E. Schore, Study Guide, Freeman, New York.
- HGS Maruzen Molecular Structure Models

Grading: The course will be graded on the basis of 625 points, distributed as follows:

- 10 best of 13 quizzes (10 points each for 100 total points)
- Each midterm exam is worth 150 points (total of 300 points).
- The final exam will be worth 225 points.

Course Grade
Final letter grades in this course will be based on the total points in the course. Distribution of letter grades will be approximately:
A (15-20%); B (35%); C (40%); D, F (5-10%)

Homework:

Homework sets will be posted regularly on the course website. The homework will not be graded, but is extremely important for understanding the material. Each set will contain suggested book problems from the 7th edition of the Vollhardt text as well as problems that I have written. Due to the fast pace of this course, it will be easy to get behind. To ensure that this does not happen, I suggest you use the text problems as a "warm-up". If you feel comfortable with the material, skip them entirely. If you are struggling, be sure to go through them so that you will have a set of problem solving skills to apply to the more difficult problems on my homework sets.

Quizzes:

Every Tuesday, starting January 27th, there will be a 10 minute, 10 point quiz administered during the lecture. The morning lecture will have a different quiz than the afternoon lecture. The quizzes will be pulled directly from the homework assignments for the first half of the course and will be closely related to the homework problems for the second half of the course. The best 10 quizzes of the total 13 will be included in your final score for the course. Because of this, there will be no make-up quizzes.

Lecture attendance:

Organic chemistry is a concentrated and fast-moving subject. It is not inherently more difficult than other science courses, but you will probably find it different from anything you have studied previously because there is a great deal of new conceptual material to assimilate. An important aspect of the subject is that it is very **cumulative,** with each new topic building upon and using concepts developed in the previous one. Because of this close interrelationship of topics, this is not a course in which it is possible to learn some topics but ignore others, especially in the first semester. It is also very difficult to wait until a few days before the midterm and final examinations to begin learning the course material. Therefore, the single factor that gives students the most trouble is **falling behind.** To avoid this problem, I strongly recommend that you come to lecture regularly, and above all **work problems as soon as they are assigned.**

Lecture attendance is particularly important, since all exams in this course will be based on the material covered in lecture. The textbook should be used as a supplement to the lectures. There may be many topics covered in lectures that are not in the text and you will be responsible for knowing this material.

Office Hours:

Dr. Pete Marsden:

- Tuesdays from 9:45-11:45 am in Bixby North (outside of Pimentel)
- Thursdays from 4:00-6:00 pm in 433 Latimer.
- Open door policy – Feel free to stop by my office in 323 Latimer and ask your questions. If the door is closed, I am not in the office or busy.
- Email – You can set up meetings with me via email. Be sure to have "Chem 3A" in the subject of the email (petermarsden@berkeley.edu).

Head GSI: Samantha Keyser (skeyser@berkeley.edu)

- Sam will hold a weekly Wednesday review session in 277 Cory Hall from 5:00-6:30 PM
- Her office hours can be found with the other GSI office hours on the Google schedule posted on bCourses.

Graduate Student Instructors: 106 Latimer Hall (schedule will be posted on bCourses)

The GSI office hours are spread out throughout the week, and are available on a walk-in basis to all enrolled students in **both Chem 3A and Chem 3AL (lab)**. You may visit any GSI during scheduled office hours. This is a very valuable resource and you are highly encouraged to bring questions regarding topics covered n lecture, lab lecture, lab, homework assignments, practice exams, etc. here on a regular basis. Access to the room can be found on the northwest face of Latimer Hall.

Course Outline: The following topics will be discussed in the order shown below (subject to change). The number of lectures per topic will vary. Topics not found in the text will be inserted when appropriate.

Topic	*Chapter.Section*
Exam 1 Material (10 lectures)	
I. Concept Review	1
a. Atomic Properties	
b. Coulomb's Law	
c. Electronegativity	
d. Bond-Line notation	
e. Hybridization	
II. Resonance	
a. Understanding the Rules	1.5, 16.2, p581
b. Acid and Base Chemistry	2.2, 2.3, 8.3, 22.3
c. Nucleophiles and Electrophiles	1.5, 2.3, 15.7
III. Molecular Orbitals	*best seen in lecture*
a. Introduction and Assumptions	
b. Constructing Molecular Orbitals	
c. Drawing Molecular Orbitals	
d. Frontier Molecular Orbital Theory	
IV. Conformational Analysis	
a. Functional Groups	2.4
b. Hydrocarbon Naming	*best seen in lecture*
c. Newman Projections	2.8
d. Eclipsed and Staggered Conformations	2.9
e. Cycloalkanes	4.2
f. Chair Cyclohexanes	4.4, 4.6
Exam 2 Material (10-12 lectures)	
V. Radical Reactions	3
a. Bond Dissociation Energies	3.1
b. Radical Stability	3.1
c. Hyperconjugation	3.2
d. Reaction Mechanisms	3.4-3.7
e. Reaction Enthalpies	2.1
f. Reaction Coordinate Diagrams	3.4-3.8
g. Radical Selectivity	3.7, 3.8
VI. Stereochemistry	5
a. Stereoisomers	5.0, 5.5, 5.6
b. Chiral vs Achiral	5.1
c. R and S Nomenclature	5.3
VII. Reactions and Stereochemistry	5.7
a. Radical Reactions and Stereoisomers	5.7
b. Transition State Analysis	p 196
c. Kinetic and Thermodynamic Product Formation	*best seen in lecture*

VIII.	Substitution Chemistry	6 and 7 and parts of 9
	a. Nucleophiles and Electrophiles	6.2
	b. Mechanisms: S_N1 and S_N2	6.4, 7.1, 7.2
	c. Stereochemical Distinctions	6.6, 7.3
	d. Effect of Nucleophile/Electrophile Structure	6.7-6.11
	e. Effect of Solvent	6.11
	f. Types of Leaving Groups	9.4, *best seen in lecture*
	g. Carbocation Rearrangements	9.3
	h. Analysis of S_N1 vs S_N2	*best seen in lecture*

Final Exam Material (6-8 lectures)

IX.	Elimination Chemistry	7 and 8
	a. Mechanisms: E1 vs E2	7.6 and 7.7
	b. Molecular Orbital Analysis (p. 263)	*best seen in lecture*
	c. Stereochemical Restrictions (11.6)	*best seen in lecture*
X.	Alkene Chemistry	11 and 12
	a. Nomenclature	11.1
	b. Hydrogenation	11.5 and 12.2
	c. Alkene Stability	11.5
	d. Synthesizing Alkenes (E1 and E2)	review
	e. Alkene Chemistry – Stepwise Mechanisms	12.3-12.7
	f. Alkene Chemistry – Concerted Mechanisms	12.8-12.12
XI.	Alcohol Chemistry	8 and 9
	a. Acidity and Basicity	8.3
	b. Epoxide Formation	review
	c. Epoxide Reactivity (Acid Conditions vs Base Conditions)	9.9
	d. Oxidation of Alcohols	8.6
	e. Reduction of Carbonyls	8.6
	f. Carbanion Nucleophiles with Carbonyl Electrophiles	8.7 and 8.8
XII.	Synthesis	*best seen in lecture*