LEWIS & CLARK COLLEGE
Department of Chemistry
Chemistry 210 Course Outline
Fall

Lecture: Mon. Wed. Fri. - 10:20 a.m.
Conferences: Mon 11:30 & 12:40 and Tues 9:00 in **Olin 102**

Organic Chemistry is the study of carbon compounds. The three key concepts that will be introduced in this course are **structure, mechanism** and **reactivity** of carbon-containing molecules. Organic chemistry is very different from General chemistry in that carbon chemistry is more qualitative. The following topics from General chemistry are of special importance, and it is encouraged that you review these concepts.

1) The general outline of the Periodic Table, the progression of various chemical properties when descending or crossing the Table such as electronegativity, electron configuration, atomic size and the character of the chemical bonds formed.

2) The physical consequences (m.p., b.p., solubility) of ionic and covalent bonding.

3) The terminology and symbols used to describe the distribution of electrons in atoms and molecules. The shapes of atomic orbitals. Valence bond and molecular orbital description of bonding (single, double, triple, and ionic), and non-bonding electrons. The calculation of formal charges in all structures. The shape and symmetry of hybrid orbitals. ***Resonance and resonance hybrid.***

4) The chemistry of acids and bases. The definition of Lewis and Lowry-Bronsted acid/bases.

5) The thermodynamics of physical and chemical processes; Le Chatelier's Principle; the relationship between Gibbs free energy and equilibrium constants.

6) The kinetics of physical and chemical processes; activation energy and the use of energy diagrams.

Student Learning Outcomes and Assessment

By the end of chem 210, students should have mastered the following principles:

- structure and bonding concepts of carbon compounds in terms of atomic and molecular orbitals.
- translation of Lewis structures and resonance hybrids into three-dimensional molecular representation
- identify the three main forms of isomerism (constitutional, configuration, stereoisomer) found in carbon compounds.
- delineate the stereochemical, thermodynamic and synthetic requirements

associated in substitution, elimination and free-radical reactions
- Write detailed and precise mechanisms for substitution, elimination and halogenation reactions including possible carbocation rearrangement.
- Understand the basic properties and synthetic methodologies for alkene, alcohol, and alkyne functional groups
- Identify carbon compounds with ^{1}H NMR spectroscopy and use the IUPAC nomenclature system for naming basic organic compounds.
- Critically analyze and solve so-called "Roadmap" problems that integrate different concepts in organic chemistry into one problem.
- Synthesize mono and bifunctional organic compounds with retrosynthetic analysis.

General Organization
The regular lectures are scheduled on MWF 10:20 a.m. in Bodine 300, all conferences will be held in Olin 102 , and **all laboratories in Olin 116**.

The conference periods will be used to discover new principles in light of old ones with all students working problems on the board; **attendance is required**. Please do not hesitate to arrange for individual conferences with your instructor.

Chemistry Help Center

First floor of Howard in Rm 143	
Mondays & Tuesdays	6:30 pm – 8:30 pm
Wednesdays	7-9 pm
Thursday	5-7 pm

Source Material
The assigned textbook is "Organic Chemistry," by David Klein. Unlike general chemistry, the course will not follow the **exact** chronological order of the text; here the text supports the lecture material. In addition, prior students have found the plastic molecular modeling kits to be very helpful for this course. These model sets are pretty small and relatively inexpensive, so you may want to get your own. Prior Chem 210 students may be willing to sell their sets to you.

The instructor will also provide some printed material summarizing key concepts of the lecture. You are asked to have a folder that will file these handouts as well as hold your returned homework assignments and exams.

Grading

Three one-hour exams (closed book/notes)	39%
Homework	16%
Lab	25%
Final	20%

Note from Student Support Services
If you have a disability that may impact your academic performance, you may request accommodations by submitting documentation to the Student Support

Services Office in the Albany Quadrangle (x7156). After you have submitted documentation and filled out paperwork there for the current semester requesting accommodations, staff in that office will notify me of the accommodations for which you are eligible.

Office Hours

To Be Arranged

If I am not in my office (Olin 216), I will be in my research lab in Olin 118 or Olin 121.

Office extension 7535 E-mail: kuo@lclark.edu

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Approximate **Lecture Schedule**, Fall 2013

Concept	Lecture Topic	Reading Assignment **Klein**
S	Introduction to Lewis Structures	1.1 – 1.4 1.5 (optional)
S	Lewis Structures II.	2.1 & 2.2, 2.4 – 2.6
S	Lewis Structures III: Resonance	2.7 – 2.11 1.11 – 1.13 for miscibility/solubility lab
S	Molecular Orbitals-Hybridization and Bonding	1.7 – 1.9 and 2.12
S	Bonding and Structure for Alkanes and Alkenes	1.9 – 1.10 and 4.1 & 4.2, but skip bicyclic compound naming
S	Conformational Analysis of Alkanes	4.5 to 4.8
S	Conformational Analysis of Cycloalkanes	4.9 to 4.14
S	Stereoisomerism I	5.1 to 5.4
S	Stereoisomerism II	5.5 to 5.9 and 8.4
	***Exam #1* In Class, one-hour**	
S	Nuclear Magnetic Resonance I	16.1 to 16.5
S	Nuclear Magnetic Resonance II	16.6 to 16.10
M	Equilibrium and Kinetics	6.1 to 6.2 and 6.4 to 6.5
M	Alkane Halogenation	11.1 to 11.4
M	Alkane Halogenation	11.5 to 11.7
M	Nucleophilic Substitution I	6.6 and 7.1 to 7.3
M	Nucleophilic Substitution II	7.4 to 7.6
M	Nucleophilic Substitution III	7.7 to 7.9
M	Elimination Reactions I	8.1 to 8.4
M	Elimination Reactions II	8.5 to 8.10
M	Elimination Reactions III	8.11 to 8.14
	Exam #2 In Class, one-hour	
R	Properties of Alcohols	13.1 to 13.3
R	Synthesis of Alcohols	13.4 to 13.4
R	Activation & Oxidation of Alcohols	13.9 and 13.10
R	Ethers	14.1 to 14.3
R	Synthesis and Reactivity of Ethers	14.5 to 14.6
R	Epoxides	14.8 to 14.10
R	Carbon nucleophiles	20.10 and 13.6
R	Properties and Synthesis of Alkenes	9.1 and review elimination rxns
R	Electrophilic/Ionic Addition w/ Alkenes	9.2 to 9.5
R	Halogenation and hydrogenation of Alkenes	9.6 to 9.8
R	Oxidation of Alkenes	9.9 to 9.12
	***Exam #3* In Class, one-hour**	
R	Alkyne Synthesis and Properties	10.1 to 10.4 and 10.10
R	Reactions of Alkynes	10.5 to 10.9

R	Synthesis strategies	9.16; 10.11; and 13.13 and13.7 (protecting grps)
R	Retrosynthetic Analysis	12.5

S=Shape/Structure M=Mechanism R=Reactivity