

## Organic Chemistry 330 (Summer 2013)

Meetings: MoTuWeTh 9:00AM - 11:45AM

Location: Faraday Hall 143

Instructor: Prof. Timothy J. Hagen

Office: FR 350, Office Hours: MoTuTh 12:00-12:50 PM or by appointment

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### Tentative Lecture Schedule

Lecture Dates	Chapters	Subject
6/17-6/20	1.2-11,13, 1.15-17	Atomic structure, electron configuration, covalent and ionic bonding, multiple bonds, organic functional groups, formal charge, hydrogen bonding, Bronsted-Lowry acids, Lewis acids, structure of acids, equilibrium in acid/base reactions, Ka and pKa, Nomenclature
	2.3,5-15,17 2.19-21	Bonding, hybridization (sp <sup>3</sup> , sp <sup>2</sup> , sp), isomeric alkanes, nomenclature, physical properties
6/20		Exam 1
6/24-6/27	3.1-11	Chemistry of alkanes (oxidation, cations/radicals/anion, halogenation); isomers; conformational isomers of alkanes and cycloalkanes.
	4.4-17	Alcohols and alkyl halides, chemistry, SN1 and SN2 reactions mechanisms, transition state, electrophiles and nucleophiles, energetics of reactions.
	5.2-4,6,8- 16,18	Structures and preparation of alkenes, elimination reactions, E1 and E2 (synthesis of alkenes); addition reactions (reactions of alkenes)
6/27		Exam 2
7/1-7/3 No class on 7/4	6.1-13, 15- 20	Addition reaction of alkenes
	7.1-8	Stereochemistry
	8.1-10, 12	Nucleophilic substitution
7/3		Exam 3
7/8-7/11	9.5-12	Alkynes
	10.1-7, 10- 13	Conjugation in alkenes and allylic systems
	11.1-9, 18- 23	Arenes and aromaticity
7/11		Exam 4

**On-Line Course Information:** Blackboard (<https://webcourses.niu.edu>)

**Materials:** "Organic Chemistry", Francis A. Carey (9<sup>th</sup> ed.), McGraw-Hill & its accompanying learning materials including McGraw-Hill Connect (on-line homework). An access code for Connect is bundled with the textbook or you may purchase one online the first time that you login to the course website.

**Class Format:** The course will be composed of lectures, in-class exams and online learning tools and assessments. **It is important that you attend class.** The in-class lectures need to be supplemented by your reading of the text, working of problems and exams. If you miss a class, it is your responsibility to acquire the lecture notes and any assigned class work from a fellow classmate and you should check Blackboard each day for postings. Solving the problems for each chapter, with a time limit, is good practice for the exams.

**BlackBoard Access:** You must know your student id login and password.  
<https://webcourses.niu.edu/webapps/portal/frameset.jsp>

**Exams and Grades:** The course grade will be assigned based on your point totals from the four exams and online homework (Learn Smart). The Learn Smart (Connect by McGraw Hill) is available through

Blackboard. The exams will be given in the second-half of the class period on Thursdays. If an exam is missed, a score of zero will be assigned. The point total is as follows:

Exam 1 (6/20)	100 Points
Exam 2 (6/27)	100 Points
Exam 3 (7/3)	100 Points
Exam 4 (7/11)	100 Points
<u>Learn Smart</u>	<u>50 Points</u>
Total Points	450 Points

**Approximate Scale:** Average grade: A (100-85%), B (84-70%), C (69-55%), D (54-45%)

**NOTE: by enrolling in this class, you are agreeing to take the exams on the scheduled dates.**

**Optional Study Group Sessions:** I will hold an optional one-hour group study session to go over material and work through problems. The time and location will be announced in class.

**Extra Credit:** THERE IS NO EXTRA CREDIT AVAILABLE.

### **Learning Outcome Expectations:**

After this course, students should be able to:

- draw Lewis dot structures, calculate formal charge, understand atom electronegativity and how it creates dipoles in bonds, determine the shape of a molecule from its Lewis dot structure, identify different functional groups, and know common bonding situation for 1<sup>st</sup> and 2<sup>nd</sup> row elements.
- identify  $\sigma$  and  $\pi$  bonds, identify the hybridization of any given atom in a molecule, identify the molecular orbital occupied by electron pairs, and identify the orbitals involved in a given bond.
- know trends in bond strengths and lengths for common bonds, recognize constitutional isomers and be able to generate them from a given empirical formula, calculate degree of unsaturation, recognize and produce organic molecules drawn in shorthand, examine the structure of a compound and determine the intermolecular forces that are operating, and understand relative physical properties and how they relate to intermolecular forces.
- name simple organic molecules using the IUPAC system.
- recognize compounds that exist as cis-trans isomers and compare stabilities, use *Z* and *E* descriptors, determine the conformations about a C-C single bond and estimate relative energies, determine types and relative amounts of strain present in cyclic molecules, draw the two chair conformations of cyclohexane derivatives, and determine and compare stability of these two conformational isomers.
- identify chiral compounds and stereocenters, designate chiral center as *R* or *S*, understand the relative properties of enantiomers, recognize *meso*-stereoisomers, determine the stereochemical relationship between two compounds, understand chiral separation techniques, and draw and use Fischer projections.
- draw important resonance structures for any molecule and assign the relative importance of such structures.
- understand Bronsted acid-base theory, write an acid-base reaction, recognize Lewis acids and Lewis bases, understand the meaning of  $K_a$  and  $pK_a$  values and use them to predict equilibrium of an acid-base reaction, and understand how structure affects acidity.
- draw the mechanisms for the  $S_N1$  and  $S_N2$  reactions, recognize various nucleophiles and leaving groups and understand the factors that control their reactivities, understand the factors that control the rates of the two substitution reactions, understand the importance of stereochemistry in the substitution reactions, and apply this knowledge to predict products from a reaction mixture.
- draw the mechanisms for the  $E1$  and  $E2$  reactions, understand the factors that control the rates of the two elimination reactions, understand the implications of stereochemistry in elimination reactions, and apply this knowledge to predict products (resulting from either substitution or elimination) from a reaction mixture.

- using substitution and elimination chemistry understand how to interconvert a variety of functional groups, including alcohols, ethers, esters, alkyl halides, amines, hydrocarbons, nitriles, phosphorous and sulfur compounds, alkenes, alkynes, ketones, aldehydes, epoxides, and cyclopropanes.  
- understand aromaticity, know the conditions and mechanisms for functionalizing benzenes using electrophilic aromatic substitution, nucleophilic aromatic substitution, and benzyne chemistry, understand how substituents on the benzene ring affects its reactivity, and use this knowledge to predict products of reactions and synthesize desired products.

**Notification Of Services For Students With Documented Disabilities** NIU abides by Section 504 of the Rehabilitation Act of 1973 which mandates reasonable accommodations be provided for qualified students with disabilities. If you have a disability and may require some type of instructional and/or examination accommodation, you will need to register with the Center for Access-Ability Resources (CAAR), the designated office on campus to provide services and administer exams with accommodations for students with disabilities. The CAAR office is located on the 4th floor of the University Health Services building (815-753-1303). Accommodations are not retroactive. Please contact me early in the semester so that I can provide or facilitate in providing accommodations you may need. You must for each exam have a form filled out about 10 business days in advance to be sure to have a CAAR test time appointment.

**Suggested homework problems:**

Chap. 1: 42b; 45; 47; 49; 51; 57a; 60b,f,g; 62a; 66; 67a; 69-72

Chap 2: 24; 29e; 35a,c; 37a; 42; 44; 45; 47; 50

Chap 3: 19; 20; 27-28; 31; 32c; 40a,b; 47

Chap 4: 23c; 24a; 27; 39a,b,d,e; 40a,d,e; 43; 44; 48; 51a

Chap 5: 28c; 30a; 36a,b; 38; 40a-d; 42; 46; 47b

Chap 6: 26; 32; 34; 36; 37; 59; 61

Chap 7: 33; 35; 36; 38; 44; 50; 51

Chap 8: 20; 22; 24; 25a-c; 31; 34; 36; 48

Chap 9: 25a-k; 29a-d, i-j; 36

Chap 10: 25; 26; 28a,b; 30; 32; 41; 45; 47; 49

Chap 11: 32; 38; 43 a-i, 50, 57