Chemistry 2110 (01) Revised

Organic Chemistry I

Fall 2005

Instructor: Dr. Wolfgang H. Kramer

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Office Hours:	T 2pm, TTh 9am, and by appointment
Lectures:	MTWF 8:00 – 8:50 am
Location:	OH 120

Text: **Organic Chemistry**, 6th Edition by John McMurry
The Study Guide/Solutions Manual accompanying this text is very useful. However, you should refer to these solutions only after you have attempted each problem! The text and solutions manual are on reserve in the library.
Models: Models are not required for this course, however they are highly recommended. We will often build molecular models in class to obtain a clearer picture from every possible angle. The use of models during exams is allowed. Darling models may be purchased over the web at the following site: http://www.webcom.com/darling/products.html. Dr. Stensaas also has several model kits that can be checked out on a weekly basis.
Computer Opportunities: Excellent links to organic chemistry resources can be found through the Millsaps Chemistry Department web page. Also, *check your e-mail* often as I will send you assignments and other important class information.

Objectives: The primary objective of this course is to provide students with an appreciation and understanding of the basic concepts involved in organic chemistry. Students will be introduced to the alkane, alkene, alkyne, aromatic hydrocarbons, and the more common heteroatom-substituted compounds of carbon. Emphasis will be placed on structure, stereochemistry, synthesis, chemical reactions, and physical properties of these compounds.
Requirements: Chemistry 1223 is a prerequisite for this course and Chemistry 2111 is to be taken concurrently.

Attendance: Class exercises, quizzes, and group discussions will not always be announced, therefore regular class attendance is required for optimum understanding and performance in this course.
Note: Students with documented learning disabilities or other disabilities are encouraged to contact me after class to discuss individual needs for accommodations.

Grading: The course grade will be based on *three exams* (180 points each), weekly Quizzes/Homework, class exercises, or homework (180 points overall), and a final comprehensive exam (280 points). The three lowest *quiz* scores will be dropped. If a student misses a quiz/class exercise, it will automatically become one of the grades dropped.
Note: *None of the exam scores* will be dropped. Plan your exam preparation mindset accordingly!

Quizzes/Homework	: 180 pts
Midterm examinations (3 x 180)	: 540 pts.
Final Examination (1 x 280)	: 280 pts.
Total:	**1000 pts.**

The course grade will depend on performance on three exams and the final exam. This course is not graded on a curve. The distribution of course points and the grade cut-offs are as follows:

A	895 -1000	A	935 – 1000
		A-	895 – 934
		B+	855 – 894
B	795 – 894	B	825 – 854
		B-	795 – 824
		C+	755 – 794
C	695 – 794	C	725 – 754
		C-	695 – 724
		D+	655 – 694
D	595 – 694	D	595 – 654
F	0 – 594	F	0 – 594

Tentative Exam Schedule: Exam 1---Tuesday, October 18 (8:00 am)
Exam 2---Friday, November 18 (8:00 am)
Exam 3---Wednesday, December 7 (8:00 am)
The *final* exam is scheduled for Tuesday, December 13 at 9:00 am.

Makeup Policy: Makeup exams are only available to those students with a written excuse from a physician or a school-related absence. If you know that you will be unable to attend one of the exams, you are required to notify me *prior* to the exam so appropriate arrangements can be made.
E-mail requests for makeups immediately prior to or after an exam will not be allowed. This policy will be strictly applied.
Grading errors: For consideration of a possible grading error on an exam or quiz, you must return it to me within one week of the date I hand it back to you. Furthermore, you must include a clear written statement of why you feel you deserve more credit.

Homework: Memorization is not the most effective technique for success in organic chemistry. There simply is too much material! Students must learn to view the material in a systematic, logical manner and identify connections and relationships. In fact, one of the greatest benefits of mastering organic chemistry is learning to think logically.

One of the most important methods for learning organic chemistry is through working problems; *lots* of problems. In other words, *you must understand how to work the assigned problems* and apply that understanding to other problems in order to do well in this course.

A list of suggested problems from McMurry's text is provided in the **Course Outline** section. These problems will not be collected or graded, so it is very important to *keep your motivation high* and work these problems diligently.

I strongly urge you to form study groups and work collaboratively at problem solving! This philosophy will work best if group problem solving is used in conjunction with independent study of the material. **Do not wait until just prior to an exam to work problems.** Procrastination is a recipe for disaster in organic chemistry.

Organic chemistry is not hard…it just requires hard work!
To be successful:
1) Attend lectures and take clear notes.
2) Review your notes before class and ask questions at the beginning of class.
3) Read the appropriate section of the text before lecture!

4) Complete the assigned problems.
5) Keep an open mind.
6) Remember that I am always here to assist you in your studies!!!

Honor Code: This course operates under the guidelines defined by the Millsaps College Honor Code. Unless stated by me, **all work turned in for a grade is pledged** individual work. Cell phones are not allowed to be taken out or used during exams!

Changes: Changes to this syllabus are not anticipated, but if necessary they will be announced in class.

ACADEMIC HONOR CODE of MILLSAPS COLLEGE

Millsaps College is an academic community dedicated to the pursuit of scholarly inquiry and intellectual growth. The foundation of this community is a spirit of personal honesty and mutual trust. Through their Honor Code, the students of Millsaps College affirm their adherence to these basic ethical principles.

An Honor Code is not simply a set of rules and procedures governing students' academic conduct. It is an opportunity to put personal responsibility and integrity into action. When students agree to abide by an Honor Code, they liberate themselves to pursue their academic goals in an atmosphere of mutual confidence and respect.

The success of the Code depends on the support of each member of the community. Students and faculty alike commit themselves in their work to the principles of academic honesty. When they become aware of infractions, both students and faculty are obligated to report them to the Honor Council, which is responsible for enforcement.

The pledge signed by all students upon entering the College is as follows:

> **As a Millsaps College student, I hereby affirm that I understand the Honor Code and am aware of its implications and of my responsibility to the Code. In the interests of expanding the atmosphere of respect and trust in the College, I promise to uphold the Honor Code and I will not tolerate dishonest behavior in myself or in others.**

Each examination, quiz, or other assignment that is to be graded will carry the written pledge: **"I hereby certify that I have neither given nor received unauthorized aid on this assignment. (Signature)"** The abbreviation "Pledged" followed by the student's signature has the same meaning and may be acceptable on assignments other than final examinations.

It is the responsibility of students and faculty to report offenses to the Honor Code Council in the form of a written report. This account must be signed, the accusation explained in as much detail as possible, and submitted to the Dean of the College.

The Honor Council, 2005-2006

Chris Spear (President)
Maggie Baumgartner (Vice-President)
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Course Outline (Tentative Timeline, not adjusted for two-week delay of classes!)

Note: McMurry **Chapters 1 & 2** contain review material from General Chemistry. You should read through these chapters and work through the problems to refresh your memory. Pay close attention to section 2.12 Drawing Chemical Structures.

1. Alkanes and Cycloalkanes: **Chapter 3 and Chapter 4**

(August 24 - September 2)

Section 3.1 Functional Groups (Table 3.1)
Section 3.2 Isomers
Section 3.3 Alkyl Groups, R
Section 3.4 Nomenclature (also Section 3.7)
Section 3.5 Properties
Section 3.6 Cycloalkanes
Section 3.8 Cis-Trans Isomerism in Cycloalkanes

Problems: 3.1-3.6, 3.8-3.12, 3.15-3.16, 3.18-3.19, 3.21, 3.24-3.25, 3.27, 3.30, 3.33, 3.39, 3.43-3.44, 3.47, 3.49, 3.52

(September 5 - September 16)

Section 4.1 Conformations of Ethane and Propane (4.2)
- -Sawhorse
- -Newman Projections

Section 4.3 Conformations of Butane
- -Anti
- -Gauche

Section 4.4 Stability of Cycloalkanes (also 4.6-4.8)
Section 4.5 Ring Strain
Section 4.9 Axial and Equatorial Bonds in Cyclohexane
Section 4.10 Ring-flips of Cyclohexane
Section 4.11 Conformations of Monosubstituted Cyclohexanes
Section 4.12 Conformations of Disubstituted Cyclohexanes
Section 4.13 Boat Conformer

Section 4.14 Polycyclic Molecules (decalins)

Problems: 4.2-4.5, 4.7, 4.11- 4.12, 4.15, 4.17, 4.20, 4.21, 4.24- 4.25, 4.29-4.30, 4.32, 4.35, 4.37, 4.53

2. An Overview of Organic Reactions: **Chapter 5**

(September 19 - September 26)

Section 5.1 Kinds of Organic Reactions
- -Additions
- -Eliminations
- -Substitutions
- -Rearrangements
- -Oxidation/Reduction

Section 5.2 Mechanisms
- -Radical Reactions (Section 5.3)
- -Polar Reactions (Sections 5.4 and 5.5)
- -Electron Pushing (Section 5.6)
- -Equilibria, Rates and Energy Changes (Section 5.7)

Section 5.8 Bond Dissociation Energies

Section 5.9 Reactions: Energy Diagrams and Transition States
- -Intermediates (Section 5.10)

Problems: 5.1-5.4, 5.6-5.10, 5.13-5.17, 5.21-5.22, 5.23- 5.24, 5.26, 5.28, 5.31, 5.37, 5.39, 5.45

3. Alkenes: **Chapters 6, 7, 14.1-14.7**

(September 28 - October 7)

Section 6.1 Industrial Prep. And Use of Alkenes

Section 6.2 Degrees of Unsaturation

Section 6.3 Nomenclature of Alkenes

Section 6.5 Cis-Trans Isomerism

Section 6.6 Sequence Rules: The E,Z Designation

Section 6.7 Stability

Section 6.8 Alkene Electrophilic Addition Reactions
- -Markovnikov's Rule (Section 6.9)
- -Carbocation Structure and Stability (Section 6.10)
- -The Hammond Postulate (Section 6.11)
- -Carbocation Rearrangements (Section 6.12)

Problems: 6.1-6.7, 6.9-6.16, 6.19-6.20, 6.23-6.24, 6.26-6.27, 6.29, 6.35, 6.37, 6.39-6.40

(October 10 - October 26)

Section 7.1 Preparation of Alkenes

Section 7.2 Addition of Halogens

Section 7.3 Halohydrin Formation

Section 7.4 Hydration of Alkenes
- -Oxymercuration
- -Hydroboration/Oxidation (Section 7.5)

Section 7.6 Addition of Carbenes: Cyclopropane Synthesis

Section 7.7 Reduction of Alkenes: Hydrogenation

Section 7.8 Oxidation of Alkenes
- -Hydroxylation (OsO_4)
- -Oxidative Cleavage (O_3 and $KMnO_4$)

Section 7.10 Radical Addition to Alkenes: Polymers

Problems: 7.1-7.10, 7.12-7.17, 7.23-7.28, 7.30-7.33, 7.36, 7.40

(October 26 - November 4)

Section 14.1 Preparation and Stability of Conjugated Dienes

Section 14.2 MO Description of 1,3-Butadiene

Section 14.3 Electrophilic Addition to Conjugated Dienes
- -Allylic Carbocations

Section 14.4 Kinetic vs. Thermodynamic Control

Section 14.5 Diels-Alder Cycloaddition Reaction
- -Characteristics (Section 14.6)

Section 14.7 Diene Polymers

Problems: 14.1-14.3, 14.6-14.9, 14.11, 14.20-14.22, 14.25, 14.27, 14.33-14.35, 14.38, 14.40, 14.44

4. Alkynes: **Chapter 8**

(November 7 - November 11)

Section 8.1 Electronic Structure of Alkynes

Section 8.2 Nomenclature
Section 8.3 Preparation
-Elimination of vicinal dihalides
Section 8.4 Reactions
-Addition of HX and X_2
-Hydration (Section 8.5)
-Reduction (Section 8.6)
-Oxidative Cleavage (Section 8.7)
Section 8.8 Alkyne Acidity: Formation of Acetylide Anions
Section 8.9 Alkylation of Acetylide Anions
Section 8.10 Introduction to Organic Synthesis
-Retrosynthetic Analysis
Problems: 8.1-8.6, 8.8-8.14, 8.19-8.20, 8.22-8.24, 8.27-8.29, 8.32, 8.38

5. Stereochemistry: **Chapter 9 and Chapter 25.2**
(November 14 – November 25)
Section 9.1 Enantiomers (9.4)
Section 9.2 Chirality
Section 9.3 Optical Activity
Section 9.5 Sequence Rules
Section 9.6 Diastereomers (9.8)
Section 9.7 Meso Compounds
Section 9.9 Physical Properties of Stereoisomers
Section 9.10 Racemic Mixtures and their Resolution
Section 9.12 Stereochemistry of Reactions
-Addition of HBr to Alkenes
-Addition of Br_2 to Alkenes (Section 9.13)
-Addition of HBr to a Chiral Alkene (Section 9.14)
Section 9.15 Chirality at Atoms other than Carbon
Section 9.17 Prochirality
Section 25.2 Fischer Projections
Problems: 9.1-9.4, 9.6-9.8, 9.11, 9.14-9.15, 9.17-9.19, 9.21-9.22, 9.24-9.25, 9.32, 9.34, 9.38, 9.40, 9.44-9.46, 9.50, 9.63-9.64, 25.2-25.4, 25.36-25.37

6. Alkyl Halides: **Chapter 10**
(November 28 - December 2)
Section 10.1 Nomenclature
Section 10.3 Preparation of Alkyl Halides
-Radical Halogenation of Alkanes (Section 10.4)
-Allylic Bromination of Alkenes (Section 10.5, 10.6)
-From Alcohols (Section 10.7)
Section 10.8 Reactions of Alkyl Halides
-Grignard Reagents
-Organometallic Coupling (Section 10.9)
Problems: 10.1-10.3, 10.5-10.12, 10.17-10.19, 10.21-10.24, 10.27, 10.31-10.33, 10.35-10.36, 10.40

7. Reactions of Alkyl Halides: **Chapter 11**
(Only if time allows)
Section 11.2 Stereochemistry of Nucleophilic Substitution
Section 11.3 Kinetics of Nucleophilic Substitution
Section 11.4 S_N2 Reactions
-Characteristics (Section 11.5)
Section 11.6 S_N1 Reactions
-Characteristics (Section 11.7, 11.8, 11.9)
Section 11.10 Elimination Reactions of Alkyl Halides
-Zaitsev's Rule
Section 11.11 E2 Reactions
-Cyclohexane conformation (Section 11.12)
Section 11.14 E1 Reactions
Section 11.15 Summary of Reactivity: S_N1, S_N2, E1, E2
Section 11.16 Substitution Reactions in Synthesis
Problems: 11.1-11.2, 11.4-11.8, 11.11-11.12, 11.14-11.17, 11.19-11.20, 11.26-11.37