CHEM 141 – Organic Chemistry I
Spring 2008
M, W, Th, F (9:00 – 9:50)

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Classroom: Nobel Hall; Rm. 105

Office Hours: Monday: 10:30 – 11:30; Wednesday: 1:00 – 2:00; Thursday: 10:30 – 11:30; other times if I am available, or by appointment. Not in the morning before lecture.

Materials:

Texts:	John McMurry, *Organic Chemistry, A Biological Approach*, 1st Edition;
OWL code	Access code to OWL, (bundled with the text or purchased separately).
Lab Text:	Pavia, Lampman, Kriz and Engel*, Microscale and Macroscale Techniques in the Organic Laboratory, 2002.*
Supplies:	A model kit: *Molecular Visions* by Darling Models. Safety goggles; bound laboratory notebook with carbon-copy duplicate pages.

Course Description: Organic chemistry involves the study of carbon-containing compounds and encompasses the chemistry of living organisms. After studying two semesters of organic chemistry, a typical student can understand most of the chemical interactions in living systems in the world around us. Thus, organic chemistry is a very powerful and empowering subject of study

Organic chemistry requires developing a set of skills that is completely different from any other that you may have previously encountered. Two-dimensional line drawings of organic structures represent three-dimensional molecules. A short-hand (in chemical jargon, "arrow-pushing") is used to explain sequences of chemical reactions. Learning to use the models and formalisms of organic chemistry is like learning a new language. As you begin to learn the "language of organic chemistry" a whole new perspective from which to view, analyze, and interpret the world becomes available to you.

The concepts of organic structure, bonding, chemical reactivity, reactions as acids and bases, mechanisms and stereochemistry will be introduced. A mechanistic approach to understanding organic reactions will be emphasized. The chemistry of alkanes, alkenes, alkyl halides, alcohols, and thiols will be covered. Competing mechanisms involved in substitution and elimination reactions are examined. Infrared (IR), nuclear magnetic resonance (NMR), ultraviolet (UV) spectroscopy and mass spectrometry (MS) will also be introduced.

Objectives: Students should begin to develop an understanding of the relationship between the three-dimensional structures and the physical and chemical (reactivity) properties of organic molecules. Typical questions we will address include:

- What is the three-dimensional shape or structure of this molecule?
- How does the shape/polarity affect the way this molecule interacts with other molecules?
- How can we describe the pathway or mechanism by which a reaction occurs?
- How can we predict the reactivity of molecules?

Tackling these questions requires building up an arsenal of skills, including:

- Predicting and drawing Lewis structures from formulas or names
- Constructing three-dimensional models (physically *and* mentally) of Lewis structures
- Predicting lowest energy isomers or conformations
- Determining favorable equilibria from equilibrium constants (i.e.: using pKa values)
- Interpreting kinetic data with respect to reaction mechanism
- Predicting the reactivity of molecules from their steric (bulky) and electronic (polar) attributes
- Writing reasonable reaction mechanisms using the "arrow pushing" formalism
- Determining organic molecular structure from spectroscopic data

Some of the theories, models or concepts that you have already learned in introductory chemistry and that are applicable to organic chemistry are Lewis structures, valence shell electron pair repulsion (VSEPR) theory, intermolecular forces, valence bond theory, hybridization of orbitals, enthalpies of reaction and combustion, bond enthalpies, and acidity/basicity. These are concepts that you should be familiar with and we will only briefly review these models and theories.

Homework: Weekly homework will be completed using the Online Web-based Learning (OWL) system. You should register for OWL before or on the first day of class, so you can do the introductory assignments to be certain that your browser is set up correctly, and to learn to use the OWL system. To get credit for the assignments, they must be completed by the set due date. There are in-chapter problems with answers given in Appendix D of the text. You should work these as well to aid in learning the material as you study it. There are also end-of-chapter problems for which the answers are not given, if you want more practice (A solution manual is available for purchase through ichapters.com or Amazon.com, but should not be needed if you make good use of the OWL system, in-chapter problems, and evening tutors.) Additional outside (non-OWL) homework may occasionally be assigned.

Tips for Success:

Read Ahead Read the assigned chapter sections prior to the start of lecture discussions. Doing so will make the lecture material more understandable. The lectures will be designed to highlight the key points of the chapters.

Keep Up The course must cover a lot of ground. To do well you must stay with the material.

Attend Class Attendance in class is essential. While the text will be followed fairly closely, additional materials and examples will supplement the lecture. Some of the material we discuss in lecture will not be in the text.

Work Hard In Class Be an active thinker during the lecture. If at the end of a lecture period all you have is a mechanical transcription of what was presented, you will have lost a major opportunity. With concentration and effort you can learn perhaps 50% of all that you will ever know about that day's topic by the end of the class period. Review your lecture notes as soon as possible, ideally on the same day as you took them.

Solve Many Problems Your homework score will be determined by the number of units mastered in OWL as well as points earned on any outside (non-OWL) hand-in problems. Don't fool yourself into thinking you know the answers in your head. I would suggest that you solve/write down many of your answers on paper before submitting in the OWL exercises. Practice at quickly and accurately drawing structures on paper is very important. You will be

asked to solve problems and write out solutions on the exams! You are encouraged to work with a partner on textbook and any outside (non-OWL) hand-in problems. However, you must be careful to distinguish between collaborative interaction and copying someone else's work. Obviously, the latter is plagiarism, and is unacceptable. Also, copying someone else's homework would do nothing to help you at exam time! *If your instructors determine that submitted papers (homework, lab reports) are exact copies of one another, those papers will each receive a zero.*

Use Models Lots of practice is required in going from the 2-dimensional world of the printed page to the 3-dimensional world where the molecules (and ourselves) exist. The molecular models will help you greatly in making that dimensional transition.

Laboratory: It is a relatively straightforward process to enter the organic laboratory and carry out a chemical reaction to prepare a new substance(s). In fact, if you have done any cooking, you are already familiar with a common procedure for performing organic transformations: mix compounds together, stir and heat! The challenge in synthetic chemistry is to *analyze* the composition and structure of the new substance(s), and to *purify* or separate the substance(s) from the reaction side-products (not necessarily in this order). Separating a mixture of organic compounds, purifying, and identifying them is generally more difficult than the preparation of those compounds. Therefore, one of the primary goals of research in organic synthesis is to develop highly selective ways of transforming molecules, so that only one major compound is produced.

"The dual challenge of analysis and purification lies at the heart of the techniques you will be learning this semester in the organic chemistry laboratory. Although the techniques may at first appear mystifying and tricky, they are essential tools for addressing the central questions of this experimental science. Some of these questions are: How do I know if this is pure? How can I verify the structure of my product? How can I separate my product from other reaction side-products? How can I purify my product? Keep in mind that the skills you will be learning are very practical, and there is a reason for each and every step! You should make it your business to understand *why* these steps are necessary and *how* they affect the desired result."[1]

Lab Times/Locations:

Monday labs	2:30 to 6:20 PM	sec. 5, Nobel 301	Pre-lab in Nobel 201
		sec. 6, Nobel 307	Pre-lab in Nobel 201
Tuesday labs	10:30 AM to 2:30 PM	sec. 7, Nobel 301	Pre-lab in Nobel 201
		sec. 13 Nobel 307	Pre-lab in Nobel 201
	2:30 to 6:20 PM	sec. 8, Nobel 301	Pre-lab in Nobel 222
		sec. 9, Nobel 307	Pre-lab in Nobel 222
Wed. labs	2:30 to 6:20 PM	sec. 10, Nobel 301	Pre-lab in Nobel 305
	5:30 to 9:20 PM	sec. 11, Nobel 301	Pre-lab in Nobel 305
Thursday lab	2:30 to 6:20 PM	sec. 12, Nobel 301	Pre-lab in Nobel 305

As noted above, labs will meet in room 201, room 222, or room 305 prior to the start of laboratory work.

Attendance: *Attendance in every scheduled laboratory, in your assigned section, is mandatory.* One missed lab is equal to a failure in the lab course. If you know of potential conflicts with your scheduled lab, you must make every effort to resolve those conflicts with a schedule change. Make up labs will

[1] G. Hofmeister, A. Splittgerber, Syllabus-Chem 141-Spring,2002

be offered by instructor discretion, ONLY if you are very ill (bed-ridden), or if you notify your instructor in advance of a college-approved conflict with your normal lab session.

Because the lab sections may be full and other students still want to get into the lab, your instructor may drop you from his or her lab section if you fail to show up for lab in the first week of the semester. If you are not registered for the section of your choice, please show up for the section you wish to enter, in order to be (possibly) added to that section. You must talk to the lab instructor.

Grading:

Lecture:

Four in-class exams:	45%
Homework (OWL exercises, other homework):	15%
Final Exam (cumulative):	20%

Laboratory:

Notebook Prelabs, Reports:	20%
	100%

Approximate Grading Scale: A: 100-92%; A-: 91-89; B+: 88-87; B: 86-82; B-: 81-79; C+: 78-77; C: 76-72; C-: 71-69; D+: 68-67; D: 66-62

At the discretion of the instructor, these cutoffs may be reduced (i.e. the final average of the class is lower than 79%). However, I will not raise the grading scale even if the class average is higher than 79%.

Notes:

- The Office of Student Advising (203 Johnson Student Union) is open daily to help students with study problems, time management problems, and other problems that might interfere with your ability to do your best work.
- There will not be any make-up exams or quizzes. If you must miss an exam because of an extreme circumstance, you must seek prior approval of the instructor.
- In the event classes are canceled because of weather, etc. on a date when a quiz or an exam was to be given, the exam or quiz will be given the next class meeting.
- If you feel there was an error in grading, you must see your instructor ***within one week of the return date***.
- If at any time during the quarter you have any questions regarding your current score and standing you are encouraged to see your instructor.

Academic Honesty: Every Gustavus Adolphus College student is required to sign the following statement before final admittance into the College and /or registration for fall courses:

"As a community of scholars, the faculty and students of Gustavus Adolphus College have formulated an academic honesty policy and honor code system, which is printed in the Academic Bulletin and in the Gustavus Guide. As a student at Gustavus Adolphus College I agree to uphold the honor code. This means that I will abide by the academic honesty policy, and abide by decisions of the joint student/faculty Honor Board."

The policy of the college states in part:

The faculty of Gustavus Adolphus College expects all students to adhere to the highest standards of academic honesty, and to refrain from any action which impinges upon academic freedom of other members of the college community. In all academic exercises, examinations, presentations, speeches, papers, and reports, students shall submit their own work.... In the case of cheating or plagiarism, the instructor will inform the student and the office of the Dean of the Faculty of the nature of the offense, the penalty within the course, and the recommendation of the instructor as to whether further disciplinary action by the Dean is warranted.

I will expect the following honor code to be signed by you and handed in to me early in the first week of class.

"On my honor, I pledge that I will not give, receive, or tolerate others' use of unauthorized aid in completing work for this course.

I will then naturally expect you to function with integrity by abiding by this pledge for the duration of the course.

In the case of Homework done individually however, you are authorized to aid one another in a limited way as follows: Since chemistry is a very collaborative endeavor & you can benefit from working with others, you are encouraged to collaborate with others as you work the problems. However, you must be careful to distinguish between collaborative interaction and copying someone else's work or solving someone else's problems for them. In the case of OWL problems for example, you may work with another individual in learning how to solve a particular type of problem, but you must then solve your own specific problems yourself. Any outside homework (non-OWL) that you turn in must be your original work, written by you in your own handwriting. Photocopies or otherwise obvious copying of someone else's paper will result in a zero on that assignment.

In the case of laboratory work, you are expected to interact & collaborate with other students while you are working in the lab. This is normal and healthy practice when working in the lab. You are not prevented from discussing observations or results with other students. However, in most cases laboratory Reports should be completed individually. Any question you have about the expectations for a particular experiment should be directed to your lab instructor.

An integral part of the honor code is non-tolerance of violations. Any student found in violation of the academic honesty policy and honor code will receive a grade of zero for that quiz, or exam. In addition, the office of the Dean of the Faculty will be notified of the nature of the offense. Repetition may result in an 'F' for the course.

Disability Accommodations: "Section 504 of the Rehabilitation Art of 1973 and the Americans with Disabilities Act (1990) work together to ensure 'reasonable accommodation' and non-discrimination for students with disabilities in higher education. A student who has a physical, psychiatric/emotional, medical, learning, or attentional disability that may have an effect on the student's ability to complete assigned course work should contact the Disability Services Coordinator in the Advising Center, who will review the concerns and decide with the student what accommodations are necessary."

Disability Services Coordinator Laurie Bickett (x6286) can provide further information.

Tentative Class Schedule

Week	Topic	Lectures	Reading	Exam
1	Structure and Bonding	Feb. 11, 13, 14, 15	Chapter 1	
2	Polar Covalent Bonds; Acids and Bases	Feb. 18, 20, 21, 22	Chapter 2	
3	Alkanes & Their Stereochemistry	Feb. 25, 27, 28	Chapter 3	Feb 29: **Exam 1**
4	Cycloalkanes & Their Stereochemistry	Mar. 3, 5, 6, 7	Chapter 4	
5	Organic Reactions	Mar. 10, 12, 13, 14	Chapter 5	
6	Alkenes & Alkynes	Mar. 17, 19	Chapter 6	Mar. 20: **Exam 2**
7	**Easter Break / Spring Break (March 21 - 30)**			
8	Alkenes; Reactions of Alkenes	Mar. 31, April 2, 3, 4	Finish Chapter 6 and Chapter 7 (sec. 1 – 5)	
9	Reactions of Alkenes; Stereochemistry	April 7, 9, 10, 11	Chapter 7 (sec. 6 – 11) Chapter 9 (sec. 1 - 8)	
10	Stereochemistry	Apr. 14, 16, 17	Chapter 9 (sec. 9 – 14)	Apr. 18: **Exam 3**
11	IR, UV Spectroscopy; Mass Spectrometry (MS) NMR Spectroscopy	Apr. 21, 23, 24, 25	Chapter 11; Chapter 12 (sec. 1 – 6)	
12	NMR Spectroscopy	Apr. 28, 30, May 1, 2	Finish Chapter 12	
13	Aromatics	May 5, 7, 8	Chapter 8 (sec. 1 – 5)	May 9: **Exam 4**
14	Substitution/Elimination	May 12, 14, 15, 16	Chapter 10	
15	Substitution/Elimination	May 19, 21	Finish Chapter 10	May 23 (Friday): **Final Exam Nobel 105, 3:30 – 5:30.**