

# CHEMISTRY 220

## FALL 2008 SYLLABUS

**Instructor:** Dr. Holly D. Bendorf  
**Phone:** Office: x 4365  
Home: 998-8647 (no later than 10:00 pm, please!)

**Office:** 209 Heim Building  
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**Course Schedule:** Lecture: MWF 9:00 - 10:05, Heim G-09  
Labs: T 7:45 - 11:35 am, T 1:00 - 4:50 pm, Th 7:45 - 11:35 am.  
Prelab in Heim 220. Lab in Heim 236.

**Office Hours:** MWF 10:15 to 11:15 am. You are also welcome to make an appointment for another time or just drop by.

**Evening Review Session:** To be announced.

**Course Description:** CHEM 220, Organic Chemistry I, is an introduction to the study of the chemistry of carbon compounds. The course covers the chemistry of alkenes and alkynes, the substitution and elimination chemistry of alkyl halides, the theory and applications of infrared spectroscopy, and the strategies of organic synthesis. The laboratory portion of the course will introduce the student to a variety of techniques for the synthesis, purification, and analysis of organic compounds.

**Prerequisite:** Successful completion of CHEM 111.

### Course Objectives

Upon completion of this course, each student should be able to:

1. Discuss bonding in organic compounds in terms of the major theories and the role played by hybridization.
2. Identify potential sites of chemical reactivity based on molecular structure.
3. Draw organic molecules and name them according to IUPAC nomenclature rules.
4. Recognize the impact that the 3-dimensional nature of molecules has on chemical behavior and be able to identify conformational and stereoisomers.
5. Predict products and propose mechanisms for reactions of alkenes, alkynes, and alkyl halides.
6. Propose multi-step syntheses of small molecules.
7. Use infrared spectroscopy, polarimetry, and physical properties, such as melting point, to characterize molecules of known structure and identify molecules of unknown structure.
8. Demonstrate proficiency with standard organic laboratory techniques for the synthesis and purification of organic compounds.

### Required Text and Materials:

- "Organic Chemistry" 7<sup>th</sup> Edition, John McMurry, Brooks Cole Publishers.
- CHEM 220 Course Materials Booklet.
- CHEM 220-221 Lab Manual.
- Molecular Model Set for Organic Chemistry (Lehman).
- Bound laboratory notebook (Freeman).
- Safety glasses or goggles.
- Lab breakage deposit of \$10, refundable upon check-out.
- Calculator with logarithmic and exponential functions. **Please note that programmable calculators, cell phones or web-enabled devices may not be used during quizzes or exams.** Calculators may not be shared during quizzes or exams.

**Optional Materials:**

Copies of the optional texts are on reserve at the library.

- "Study Guide and Solutions Manual for Organic Chemistry" John McMurry.
- "Organic Chemistry as a Second Language" 2<sup>nd</sup> Edition, David Klein.
- Study guide for the ACS Exam in Organic Chemistry

Available at: [http://www4.uwm.edu/chemexams/order/SG\\_2008\\_form.pdf](http://www4.uwm.edu/chemexams/order/SG_2008_form.pdf)

<b>Grading Criteria:</b>	Quizzes	105 points
	Exams	300 points
	Laboratory	120 points
	Final	<u>125 points</u>
		650 points

Final letter grades will be assigned as follows: >90% A, 80-90% B, 70-80% C, 60-70% D, <60% F. The ranges given include "+" and "-" grades. **Please be aware that you must pass both the lecture and laboratory to receive a passing grade for the course.**

You can calculate your average at any time during the semester by dividing the number of points (don't forget to keep track of your bonus points and any absences) earned by the number of points possible and multiplying by 100.

**Exams:** There are three in-class exams on the following dates: **Wednesday, September 24; Wednesday, October 22; and Wednesday, November 19.** The registrar's office has scheduled our final exam for **Friday, December 12 at 8:30 am.** The ACS exam in organic chemistry is given as the final exam in CHEM 221 (and not in CHEM 220).

**Quizzes:** Quizzes are an incentive to stay current with the course. They provide you with a means of evaluating your progress and allow you to identify any potential "trouble spots" before the exam. The lowest quiz grade will be dropped.

**Assignments from the Text:** The course outline lists reading assignments for the semester. I suggest you skim the assignment before class and then read it again more thoroughly afterwards. I highly recommend taking notes on the reading. Chapter outlines and homework assignments are in the course materials booklet. Although the homework problems are not collected, you should complete them before the next class period to insure that you understand the material. Lectures, quizzes, and in-class exercises are prepared with the expectation that you have read the assigned material and have completed the problems.

**Attendance at class and lab:** Regular attendance at lecture is mandatory. Attendance at class means arriving on time, remaining in class for the entire 65 minutes, and participating in class. Missing part of a class (late arrival, early departure, etc.), sleeping or reading during class, or engaging in disruptive activities is equivalent to an absence and will be counted as such. Three absences are permitted and each absence beyond that, regardless of the reason, results in a 2-point deduction from the final course grade.

*- If you miss a quiz, you will receive a grade of zero on that quiz (remember, you get to drop one quiz).*

*- If you miss an exam, you will receive a grade of zero on that exam. If you cannot attend class that day due to exceptional circumstances and I approve the absence, you may substitute your grade on the final for the missed exam. **You must be able to provide documentation regarding the reason for the absence.** Keep in mind that routine doctor's appointments or simply not feeling well are not considered exceptional circumstances.*

*- If you miss a lab, you will receive a grade of zero for that lab. Lab make-ups may be permitted if the absence receives prior approval. Labs must be made up during another regularly scheduled lab period. Arriving late to prelab will result in a deduction from the lab grade.*

**Review Session:** The evening help session is an informal workshop where you will have the opportunity to work problems individually or in groups, ask questions and review lecture material.

**Additional resources:** Course materials, such as answer keys and review session handouts, will be placed on the Moodle site for this course. Go to [moodle.lycoming.edu](http://moodle.lycoming.edu), login using your Novell username and password, select Organic Chemistry I from Fall 2008 list. If prompted for a password or key, enter chem220.

Copies of several organic chemistry texts are available in the reading room (217 Heim Bldg.). If you are not satisfied with McMurry's treatment of a topic, feel free to consult one of the other textbooks--you may just find one you like. These texts are excellent sources of extra practice problems (solutions manuals are available for several of the texts as well).

The Department of Chemistry web site, <http://www.lycoming.edu/chemistrydept/index2.htm>, includes links to syllabi, chemistry curriculum, faculty and student research, colloquium schedule, and other chemistry-related sites.

The on-line catalogs and databases are good sources of information for your lab reports. We'll talk more about them at the first lab meeting.

Acros Organics Catalog

[www.acros.be](http://www.acros.be)

Aldrich Catalog

[www.sigmaaldrich.com](http://www.sigmaaldrich.com)

Alfa Aesar

[www.alfa.com](http://www.alfa.com)

Chemfinder

[chemfinder.cambridgesoft.com](http://chemfinder.cambridgesoft.com)

**Extra Credit:** There are several extra credit opportunities available in this course and the bonus points earned may be used to "bump up" your final course grade by a maximum of half of a letter grade (i.e.; from a B+ to an A-). Extra credit points can be earned by attending departmental colloquia (3 per colloquium) or by writing a research paper on an organic chemistry-related topic. The instructor must approve the topic and will provide additional details regarding the requirements for the paper upon request. Extra credit papers must be submitted via [turnitin.com](http://turnitin.com) and will not be accepted after the last class meeting. Other extra credit opportunities may arise in class throughout the semester. Extra credit / colloquium bonus is capped at 15 points.

**Colloquium attendance guidelines:** Colloquium speakers may be your fellow students or visitors from other academic institutions or industry. The speakers have spent a lot of time and effort preparing for colloquium and deserve to be treated with respect. Arrive on time and stay until the end, including the question and answer period (plan on 45 minutes for an internal speaker, 60 minutes for a visitor). Please give the speaker your full attention.

**Cell phones, PDAs and Laptops are not permitted in class, in lab or at colloquium.** If you have one with you, be sure it remains in your purse or backpack and is turned off. The presence and/or use of one of these devices during a quiz or exam will constitute an act of academic dishonesty.

**Academic Integrity:** Be aware that in accordance with the College's policy on academic honesty, any work you submit must be your own. Any instances of plagiarism (including copying answers from a classmate) will be penalized to the fullest extent possible and reported to the Dean of the College.

**Course Outline:** The outline below is intended to give you an idea of what we will cover and when – more detailed outlines with reading and homework assignments are provided in the course materials booklet. Most importantly, this outline lists the dates of all in-class quizzes and exams.

<b>Date</b>	<b>Subject</b>	<b>Text</b>	<b>Q/E</b>
<b>Week 1</b>			
Aug. 25	Intro. to Organic, Atomic Structure	1.1-3	
Aug. 27	Lewis Structures, Bonding Theory, MO Theory	1.4-5, 12	
Aug. 29	Hybridization	1.6-11	
<b>Week 2</b>			
Sept. 1	Drawing Structures, Electronegativity and Polar Bonds	1.12, 2.1-3	
Sept. 3	Formal Charges, Non-Covalent Interactions	2.3, 13	quiz
Sept. 5	Functional Groups, Isomers	3.1-2	
<b>Week 3</b>			
Sept. 8	Alkanes: Properties, Nomenclature, Conformations	3.3-8, 10.1	
Sept. 10	Conformations of alkanes Cycloalkanes: Properties, Nomenclature,	3.6-7	quiz
Sept. 12	Conformations	4.1-4	
<b>Week 4</b>			
Sept. 15	Cyclohexane Conformers	4.5-9	
Sept. 17	Organic Reactions and Mechanisms	5.1-5	quiz
Sept. 19	Polar Reactions, Arrow Notation	5.6; 6.9	
<b>Week 5</b>			
Sept. 22	Resonance	2.4-6	
Sept. 24	EXAM 1		EXAM
Sept. 26	Acid-Base Chemistry	2.7-11	
<b>Week 6</b>			
Sept. 29	Acid-Base Chem.; Kinetics and Thermodynamics	5.7-11	
Oct. 1	Alkenes: Structure and Nomenclature	6.1-6	
Oct. 3	Electrophilic Addition: Reaction with HX	6.7-11	
<b>Week 7</b>			
Oct. 6	Carbocation Reactivity and Rearrangements	6.7-11	
Oct. 8	Electrophilic Addition of X <sub>2</sub> to Alkenes	7.1-3	quiz
Oct. 10	Electrophilic Addition of H <sub>2</sub> O to Alkenes	7.4-5	
<b>Week 8</b>			
Oct. 13	Other Addition Reactions of Alkenes	7.7-9	
Oct. 15	Alkynes: Structure, Properties, Nomenclature, Prep'n	8.1-2	quiz
Oct. 17	Addition Reactions of Alkynes	8.3-6	
<b>Week 9</b>			
Oct. 20	Acid-Base Chemistry of Alkynes	8.7-8	
Oct. 22	EXAM 2		EXAM
Oct. 24	Multistep Synthesis	8.9.	

**Week 10**

Oct. 27	DU Calculations, IR: Theory, Functional Group Abs.	6.2; 12.5-8	
Oct. 29	IR Practice	12.5-8	
Oct. 31	No Classes - Long Weekend		

**Week 11**

Nov. 3	Stereochemistry: Chirality	9.1-4, 9	
Nov. 5	Assigning Absolute Configuration	9.5.	quiz
Nov. 7	Enantiomers, Diastereomers & Meso Cmpds	9.6-9	

**Week 12**

Nov. 10	Stereochem. in Reactions; Atoms Other Than C	9.10-14	
Nov. 12	SN2: Kinetics and Mechanism	11.1-3	quiz
Nov. 14	SN2: Leaving Group and Nucleophile	11.1-3	

**Week 13**

Nov. 17	SN1	11.4-6	
Nov. 19	EXAM 3		EXAM
Nov. 21	E1	11.7, 10; 7.1	

**Week 14**

Nov. 24	E2: Kinetics and Mechanism	11.7-9, 11	
Nov. 26	No Classes - Thanksgiving		
Nov. 28	No Classes - Thanksgiving		

**Week 15**

Dec. 1	E2: Stereochemistry, Bulky Bases	11.7-9, 11	
Dec. 3	Acid Cat. Subst. & Elim.; Sn1, Sn2, E1 & E2 Summary	11.12.	quiz
Dec. 5	Organic Synthesis	8.9.	

**Final Exam: Friday, December 12 at 8:30 am**

**Study Suggestions:** The best advice I can give you on how to succeed in this course is: Don't get behind! We cover a lot of material in this class and cramming for a night or two before an exam will not work. Every topic in this course builds upon material covered in earlier sections and you need to be fluent with one chapter before moving on to the next. Just like learning a foreign language or becoming proficient at a sport, you need to practice a bit each day. Review your class notes, read and take notes on the text, discuss the material with your classmates, quiz yourself, and work lots of problems. And remember, my job is to help you learn organic chemistry--if you have questions, if you are not sure how to approach a certain type of problem, or if a concept is still a little fuzzy, please ask me about it!

## CHEM 220 Laboratory

It is imperative that you come to the lab fully prepared. Careful planning and preparation before you arrive at the lab will allow you to complete your experiments in an efficient and safe manner. It is your responsibility to read and understand the lab procedure before you arrive at prelab. Arriving at prelab late or unprepared will result in a reduced lab grade (up to 5 points per violation) and/or dismissal from the lab.

The laboratory grade is worth a total of 120 points and is comprised of eight lab write-ups (80 points total), three lab quizzes (30 points), and a lab technique evaluation (10 points). The lab technique grade is based on the following criteria: preparation for lab, safety in the laboratory, ability to work efficiently in the laboratory, ability to successfully complete experiments, and laboratory hygiene.

Lab Safety: Unsafe behavior in the lab will not be tolerated and violations will be penalized. Repeated violations during a class may result in a zero for that lab. Keep in mind that lab safety includes laboratory hygiene. In the event that common areas are left dirty, (rotovaps, balances, melting point apparatus, reagent hood) points may be deducted from the entire lab section. If you have any questions regarding lab safety, please do not hesitate to ask.

### Lab Outline:

Week	Dates	Lab	Assigned Reading	Report due for:*
1	Aug. 26, 28	Check-in	Chp. 1, 2, 3	
2	Sep. 2, 4	Synthesis of Isobutyl Propanoate	Chp. 12, 17, handout	
3	Sep. 9, 11	Purification of Isobutyl Propanoate	Chp. 6, 15	
4	Sep. 16, 18	Recrystallization of Benzoic Acid and Naphthalene	Chp. 4, 9-11	Isobutyl Propanoate
5	Sep. 23, 25	Solubility Testing	Chp. 3, 9-11	Recryst. Part I
6	Sep. 30, Oct. 2	Extraction	Chp. 12-14	<b>Quiz 1</b>
7	Oct. 7, 9	Extraction	Chp. 12-14	Recryst. Part II
8	Oct. 14, 16	Dilantin, Part 1	Chp. 17-19	Extraction
9	Oct. 21, 23	Dilantin, Part 2	Chp. 17-19	Dilantin Part I
10	Oct. 28, 30	Limonene	Chp. 24-26	<b>Quiz 2</b>
11	Nov. 4, 6	Limonene Characterization	Chp. 25, 26	Dilantin Part II
12	Nov. 11, 13	E2	Chp. 17, 23	Limonene
13	Nov. 18, 20	E2 Characterization	Chp. 20, 23	
14	Nov. 25, 27	Thanksgiving--No Labs		E2 lab due 12/5/08
15	Dec. 2, 4	Check-out		<b>Quiz 3</b>

\*Late reports will be penalized 5% per day.

**Lab reports will not be accepted after graded labs are returned.**

More information on lab safety, procedures and reports will be provided at the first lab meeting.

**Academic Integrity:** Be aware that in accordance with the College's policy on academic honesty, any work you submit must be your own. Any instances of plagiarism (including copying answers from a classmate) will be penalized to the fullest extent possible and reported to the Dean of the College.