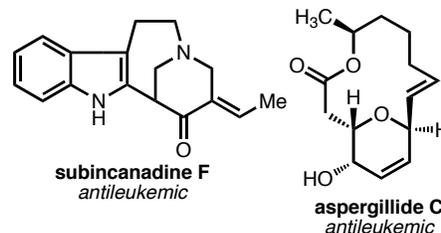


**Organic Chemistry  
Chemistry 142**



Instructor: Stephen P. Waters; Office: Cook A321; email: Stephen.Waters@uvm.edu

BlackBoard Site: bb.uvm.edu

Lecture: 4:05 pm – 5:20 pm MW, Angell B106

Recitations/Review sessions: 5:30 pm Thursdays, Fleming Museum, Room 101

UVM Holidays: Classes will not be held on January 19<sup>th</sup>, February 16<sup>th</sup>, March 2<sup>nd</sup>–6<sup>th</sup>

**Laboratory Starts the Week of Jan 26<sup>th</sup> – Jan 29<sup>th</sup>**

**Required Text and Course Materials:**

*Organic Chemistry*, Klein, 2nd ed., Wiley (required)

*Chem. 142 Laboratory Manual* (available from 1st floor stockroom, Cook A143)

Bound lab notebook with numbered pages (can continue to use that purchased for 141).

Safety glasses (available in the UVM Bookstore)

**Recommended Text and Course Materials:**

*Organic Chemistry*, Study guide by same author (strongly recommended)

Molecular Structure Models (e.g.: ISBN: 0471-362719)

*Organic Chemistry I as a Second Language: Translating the Basic Concepts*, D. Klein

*Organic Chemistry II as a Second Language: Second Semester Topics*, D. Klein

**Books in library that you may find useful:**

*The Art of Writing Reasonable Organic Reaction Mechanisms* R.B. Grossman; ISBN:0-387-95468-6

*Writing Reaction Mechanisms in Organic Chemistry* A. Miller; ISBN: 0-12-496711-6

**Course Prerequisite:** Chemistry 141 or 143.

**Office hours:**

Monday	11:00 – 12:00
Thursday	2:00 – 3:00

TA Office hours are arranged according to lab section. If you can't attend office hours, or you need to see the instructor or TAs outside office hours, make an appointment.

*Religious Holidays: Students have the right to practice the religion of their choice. Each semester students should submit in writing to their instructors by the end of the second full week of classes their documented religious holiday schedule for the semester. Faculty must permit students who miss work for the purpose of religious observance to make up this work.*

**Grading:** 3 Midterm exams (55% total); Cumulative final (20%); Lab grade (20%); Online homework assignments (5%)

No exam grades are dropped. However, if you do better on the final exam than your lowest midterm exam grade, I will drop your lowest midterm exam grade and count the final exam grade twice. No exams will be curved. The only valid excuses for missing an exam are medical or other true emergency situations. If you miss an exam for such a reason, you must inform me of it promptly, present appropriate documentation of your excuse, and receive formal approval to take a make up exam. If you miss an exam for any other reason, you will receive a grade of zero for that exam. There will be only one make-up exam given during the semester; it will be scheduled at the end of the semester, and it will be cumulative.

**However, please note:** *You must earn a passing grade in the laboratory to receive a passing grade for the course. More than two laboratories missed for any reason will result in a failing grade for the course (unless granted an incomplete by your Dean).*

**Exam Re-grades:** If you have any questions concerning the grading of an exam, you must see me within one week after the day the exam is returned to the class. Exams must be taken in ink to insure that you can get points for a grading error.

**Midterm Dates:**

Thursday, February 12<sup>th</sup>                      5:30 P.M.–7:30 P.M.

Thursday, March 19<sup>th</sup>                      5:30 P.M.–7:30 P.M.

Thursday, April 16<sup>th</sup>                      5:30 P.M.–7:30 P.M.

**Where to take your midterm exams:** Due to class size, the midterms will be held in two separate rooms as follows:

Last Names **A–K** will take exams in **Rowell Room 103**

Last Names **L–Z** will take exams in **Fleming Museum Room 101**

**Final Exam Date:**

Friday, May 8<sup>th</sup>                      1:30 P.M. – 4:15 P.M.                      Place: **Angell B106 for all students**

**Academic Conduct:** Cheating will be considered grounds for failing the course. All graded assignments must be your own work. Cases of cheating or plagiarism *will* lead to further disciplinary action which may include dismissal from the University according to the rules set forth in The University of Vermont's *Code of Academic Integrity*.

**Policy of Electronic Device Usage on Exams:** In short, you can't use them! The use of any electronic device (calculator, cell phone, ipod, headphones, tablet, laptop, or anything else with batteries or a solar cell) is strictly forbidden on exams and will be considered cheating.

**Thursday Evening Recitations:**

Each week (except exam weeks) we will hold a Thursday evening recitation in Fleming 101. This is a perfect opportunity to practice problems and work through some of the tricky points in regards to the new concepts. The sessions are not graded but many students find these recitation sessions to be very helpful.

### General Comments

In Chemistry 142 we continue to explore the basic principles of Organic Chemistry with a greater emphasis on the chemical reactivity of various functional groups (i.e. more similar to the last 1/3 of the first semester course). You will also learn about the analytical instrumentation used on a daily basis by chemists to determine the structure and composition of organic molecules.

By now you have probably noticed that Organic Chemistry involves many new concepts and a very large number of reaction mechanisms. However, as the course progresses and your organic “intuition” develops, you will discover that a relatively small subset of first principles nicely tie together the seemingly vast amount of information contained in the text. A special effort made at the beginning of the course to review and master important concepts from the first semester will pay off as the course progresses. Topics that are especially important to review include:

Arrow Pushing: Arrow pushing may be the most important tactic of organic chemistry because it allows you to show a pictorial representation of a reaction mechanism. When done properly, arrow pushing will allow you to keep track of the bonds that are made and broken throughout the course of a reaction, as well as keep track of any formal charges that develop. Having a good grasp of arrow pushing will make learning the large number of reactions you will see in this course easier, because you will then understand the underlying mechanism of the reaction rather than trying to memorize it as a “fact”. ***I can't overemphasize the importance of having a good working knowledge of arrow pushing.*** Be forewarned that arrow pushing will be used on a daily basis in class and you will be expected to write mechanisms using correct arrow pushing on exams.

Resonance: This is a very important concept and you have already seen that resonance can help rationalize why carboxylic acids are acidic and alcohols are not. You will see resonance used over and over again to rationalize why molecules react the way they do, and a good understanding of the rules for writing proper contributing “structures” to resonance hybrids will make the understanding of reaction mechanisms considerably easier. In order to have a good understanding of resonance you must also have a good grasp of electronegativity and arrow pushing.

Electronegativity: An understanding of the relative electronegativity of atoms is essential to understanding why molecules react the way they do. For example, the concept of electronegativity allows you to rationalize why some atoms are good leaving groups and others are not.

Chemical Reactions: You will be expected to know all the chemical reactions you covered in Chem. 141.

Nomenclature: Particularly, the names of all the functional groups as well as the standard IUPAC rules for naming simple organic compounds. If you don't know the functional groups, you will not be able to follow the discussion in class.

Stereochemistry: Determining *R/S* designations as well as *E/Z*. Understanding the difference between different types of stereoisomers (enantiomers/diastereomers) and being able to correctly identify the stereochemical relationship between compounds (i.e. are they diastereomers, enantiomers, constitutional isomers, different molecules, etc.).

**Keys to success in Organic Chemistry:**

- Do not try to cram!
- Work as many practice problems as possible. Practice problems reinforce the new concepts and are the only way to test your understanding of the material.
- You will see many new concepts in this course. Try to write out an explanation of the concepts in your own words as if explaining them to someone else.
- Do not look at a problem's answer until you have really tried the problem. After seeing the answer it often seems obvious and you may assume you understand.
- When you get a problem wrong, try to understand where your thinking was in error and attempt to identify what concept you missed.
- Come to review sessions, office hours or make an appointment with me or your T.A. to resolve any questions early!
- Review the material frequently.

*For each chapter you should work as many of the suggested problems as possible. I strongly urge you to keep up with your reading and problem solving. Learning organic chemistry takes a combination of patience, practice, and repetition. Cramming does not work well in this subject!*

**This course will address learning goals 1,2,3, and 5 below for chemistry majors:**

1. Students will demonstrate general knowledge in chemistry and will be able to apply chemical and physical principles in the solution of qualitative and quantitative chemical problems.
2. Students will understand the interplay of observational data, hypotheses, and hypothesis-driven experimentation through application of the scientific method.
3. Students will become proficient in chemical laboratory techniques and be able to apply these to practical and current problems in research.
4. Students will be able to read and critically evaluate the scientific literature.
5. Students will learn to present scientific data clearly and effectively through both written and verbal communication.

**Concepts you must understand from General Chemistry:**

- Properties of covalent bonds and hybridization
- The octet rule
- Structural isomers
- Formal charges
- Resonance
- Electronegativity and bond polarity
- VSEPR (Valence Shell Electron Pair Repulsion)

**Tentative Outline of Course**

Chapter 15. Infrared Spectroscopy and Mass Spectrometry  
Sections 15.1–15.7, 15.8–15.9, 15.16

Chapter 16. Using Nuclear Magnetic Resonance Spectroscopy to Deduce Structure  
Sections 16.1–16.12

Chapter 13. Alcohols  
Sections 13.2–13.4; 13.6; 13.9–13.10

Chapter 14. Ethers and Epoxides (very brief!)  
Sections 14.1; 14.3; 14.5; 14.8; 14.10; 14.12

Chapter 17. Conjugated Pi Systems and the Diels–Alder Reaction  
Sections 17.1; 17.2; 17.4; 17.7

Chapter 18. Aromatic Compounds  
Sections: 18.1–18.3; selected portions of 18.4 and 18.5, 18.6

Chapter 19. Aromatic Substitution Reactions  
All Sections except 19.13–19.15

Chapter 20. Aldehydes and Ketones  
All Sections except 20.2; 20.8; and 20.13

Chapter 21. Carboxylic Acids and Their Derivatives  
All Sections except 20.15

Chapter 22. Alpha Carbon Chemistry: Enols and Enolates  
Sections 22.1–22.4, selected portions of 22.5 and 22.6

Time Permitting: Chapter 23. Amines  
Sections 23.1; 23.3–23.7

**CHEM 142 Lab Schedule – Spring 2015**

Date	Expt #	Title	Page
1/26–1/29		CHECK IN	3–8
2/2–2/5	1	Reduction of Vanillin	9
2/9–2/12	2	Oxidation	12
2/16–2/19		NO LAB/PRESIDENT'S DAY HOLIDAY	
2/23–2/26	3	Generation and Reaction of an Organometallic Compound Part 1	15
3/2–3/5		NO LAB/ SPRING RECESS	
3/9–3/12	4	Generation and Reaction of an Organometallic Compound Part 2	15
3/16–3/19	5	Diels-Alder Cycloaddition	18
3/23–3/26	6	Nitration of Methyl Benzoate	21
3/30–4/2	7	The Wittig Reaction	24
4/6–4/9	8	Production of Biodiesel	27
4/13–4/16	9	Synthesis of Aspirin	29
4/20–4/23	10	Solventless Aldol and CHECKOUT	31

## On-line resources that may be useful to you

<http://bcs.whfreeman.com/organic6e>

Publisher's website has:  
Online quizzes  
Animated Reaction Mechanisms  
Animated Orbital Images  
Nomenclature Exercises  
Videos of lectures given by author of our textbook

<http://www.aceorganicchem.com/resources.html>

“Organic Chemistry Best of the Web 2010” – compilation of websites

<http://www.chemtube3d.com/Main%20Page.html>

High quality videos of organic reaction mechanisms.

<http://ochem.jsd.claremont.edu/intro.htm>

On-line flash cards  
Video Tutorials  
Practice Problems