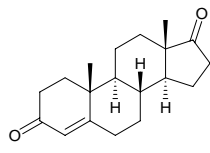
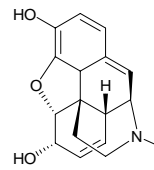


Strychnine  
(poison)

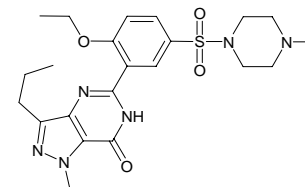


Androstenedione  
(estrogen and testosterone  
precursor)

## Organic Chemistry Chemistry 142 Spring 2010



Morphine  
(opiate analgesic  
drug)



Viagra  
(vasodilation by  
inhibition of PDE5)

**Instructor:** Matthias Brewer; Office: Cook A335; email: Matthias.Brewer@uvm.edu

**BlackBoard Site:** bb.uvm.edu

**Lecture:** 10:40am – 11:30am MWF, Angell B106

**Review Sessions:** 6:15pm Wed., Given E131

**Laboratory Starts Week of Feb 1<sup>st</sup>**

### Required Text and Course Materials:

Organic Chemistry 5th ed., Mark Loudon, Roberts and Company, 2009 (ISBN: 978-0-981-5194-3-2)

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

Bound lab notebook with numbered pages (available in the UVM Bookstore).

Safety glasses (available in the UVM Bookstore)

### Recommended Text and Course Materials:

Organic Chemistry Study Guide and Solutions Manual 5<sup>th</sup> ed., Loudon and Stowell, Roberts and Company, 2009 (ISBN: 978-0981519449)

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

### Useful Books on Reserve in Bailey/Howe Library:

Organic Chemistry I as a Second Language: Translating the Basic Concepts 2<sup>nd</sup> ed., D. Klein; ISBN: (978-0470-12929-6)

Organic Chemistry II as a Second Language: Second Semester Topics 2<sup>nd</sup> ed., D. Klein; ISBN: (978-0-471-73808-4)

### Other Books in library that may also be 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:

Mon 11:30-12:45

Wed 1:00-2:00

Friday 11:30-12:30

TA Office hours are arranged according to lab section.

If you need to see the instructors or TAs outside office hours please make an appointment. Email is the best way to get a quick answer to a question.

## 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 molecules.

By now you have probably noticed that Organic Chemistry involves many new concepts, a large number of rules and a very large number of reaction mechanisms. However, as the course progresses and your organic “repertoire” grows, you will also find that a relatively small subset of rules serves to tie together the 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 “tool” 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.

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 stereoisomer (enantiomers/diastereomers) and being able to correctly identify the stereochemical relationship between compounds (i.e. are they diastereomers, enantiomers, constitutional isomers, different molecules, etc.).

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.

**Key's 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.
- Ask questions!
- 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.
- Many people find that flash cards are a good way to learn this material.

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!

**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, or anything else with batteries or a solar cell) is strictly forbidden on exams and will be considered cheating.

**Grading:** 2 mid-terms (out of 3 offered) = 50%; Final exam = 25%; Lab grade = 25%  
The course grade will be based on the best two scores of three mid-term exams, a compulsory cumulative final exam and a laboratory grade. That is, three mid-term exams will be offered and the lowest mid-term grade will be dropped. Final exam grades will not be dropped. No makeup exams will be offered; if you miss an exam for any reason, you will receive a grade of zero for that exam (this zero can count as your lowest exam grade that is dropped). Just like last semester, no curves will be applied to mid-term exams. The exams provide 75% of your course grade and the lab component of the course will deliver the remaining 25%. **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 you are 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:**

Wednesday, February 24 <sup>th</sup>	6:15 P.M.-8:15 P.M.	Place: TBA
Wednesday, March 31 <sup>st</sup>	6:15 P.M.-8:15 P.M.	Place: TBA
Wednesday, April 21 <sup>st</sup>	6:15 P.M.-8:15 P.M.	Place: TBA

**Final Exam Date:**

Thursday, May 6 <sup>th</sup>	8:00 A.M.-11:00 A.M.	Place: TBA
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**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 chemical and scientific literature.
5. The students will learn to present scientific data clearly and effectively through both written and verbal communication.

*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.*

### Tentative Outline of Course

Chapter 14. The Chemistry of Alkynes.

Sections 14.1, 14.2, 14.4-14.10

Suggested Problems: 14.1-14.3, 14.7-14.34, 14.36-14.39, 14.42-14.45

Chapter 15. Dienes, Resonance, and Aromaticity.

All Sections

Suggested Problems: 15.3-15.33, 15.35, 15.38-15.48, 15.50-15.67, 15.69, 15.73, 15.75

Chapter 16. The Chemistry of Benzene and its Derivatives.

Sections 16.1-16.2, 16.4-16.7

Suggested Problems: 16.1, 16.2, 16.12-16.15, 16.17-16.31, 16.32-16.34, 16.38-16.49, 16.51-16.56, 16.58(a-c), 16.59-16.64, 16.66

Chapter 17. Allylic and Benzylic Reactivity.

All Sections

Suggested Problems: 17.1-17.14, 17.16-17.19, 17.21(b), 17.22-17.31, 17.33, 17.36-17.38, 17.40, 17.41, 17.44-17.47

Chapter 18. The Chemistry of Aryl Halides, Vinylic Halides and Phenols

Sections 18.1-18.4, 18.7, 18.9

Suggested Problems: 18.1, 18.3-18.5, 18.30, 18.31, 18.38, 18.39, 18.44(a-d), 18.45(a-g), 18.47-18.59, 18.62, 18.63, 18.75

Chapter 12. Introduction to Spectroscopy. Infrared and Mass Spec.

All Sections

Suggested Problems: All problems

Chapter 13. Nuclear Magnetic Resonance Spectroscopy.

All Sections

Suggested Problems: 13.1-13.44, 13.48-13.55, 13.57, 13.60-13.61

Chapter 19. The Chemistry of Aldehydes and Ketones. Carbonyl-Addition Reactions

All Sections

Suggested Problems: 19.1, 19.3-19.47(a), 19.48, 19.49(a-f, i-m), 19.50-19.58, 19.60-19.65, 19.67-19.68.

Chapter 20. The Chemistry of Carboxylic Acids.

All Sections

Suggested Problems: 20.1-20.26, 20.29-20.32, 20.35-20.39(a,c), 20.40-20.44(a), 20.45-20.47, 20.49, 20.51-20.56

## Chapter 21. The Chemistry of Carboxylic Acid Derivatives.

All Sections

Suggested Problems: 21.1-21.4, 21.7-21.57

Chapter 22. The Chemistry of Enolate Ions, Enols, and  $\alpha,\beta$ -unsaturated Carbonyl Compounds

All Sections

Suggested Problems: 22.1-22.30, 22.33-22.35(a), 22.36-22.37, 22.39-22.47, 22.49-22.65, 22.69-22.89

## Chapter 23. The Chemistry of Amines.

All Sections except 23.11C.

Suggested Problems: 23.1-23.9, 23.11-23.15, 23.17-23.29, 23.32-23.42, 23.45-23.51, 23.53-23.55, 23.57-23.59(a-j), 23.60, 23.62, 23.64, 23.65-23.68, 23.70-23.74

## Chapter 26. Amino Acids, Peptides, and Proteins

All Sections

Suggested Problems: 26.1, 26.2, 26.4, 26.5, 26.7-26.9, 26.11-26.28, 26.37-26.49, 26.62-26.69, 26.71, 26.73

## Chapter 24. Carbohydrates

All Sections

Suggested Problems: All problems

Concepts you must understand from General Chemistry:

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