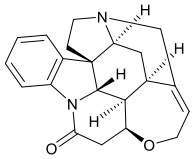
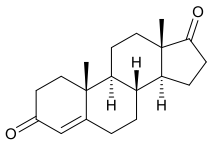
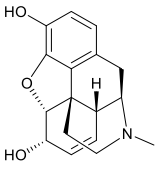


Strychnine
(poison)

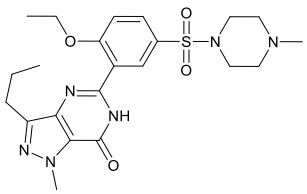


Androstenedione
(estrogen and testosterone precursor)

Organic Chemistry For Majors 2
Chemistry 48



Morphine
(opiate analgesic drug)



Viagra
(vasodilation by inhibition of PDE5)

Instructor: Matthias Brewer; Office: Discover 107; Matthias.Brewer@uvm.edu
BlackBoard Site: bb.uvm.edu
Lecture: 10:50am – 11:40am MWF, Kalkin Building, Room 003
First Laboratory Meeting: Jan 23 (Check-in)

Required Course Materials:

Organic Chemistry 6th ed., Loudon and Parise, Roberts and Co., 2016 (ISBN: 9781936221639)

Organic Chemistry Study Guide and Solutions Manual 6th ed., Loudon and Parise, Roberts and Co., 2016

Sapling Learning account: account can be purchased as part of book order.

Recommended Course Materials:

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

Books on reserve in library that may be useful:

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

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

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 47

Office hours: Monday, Wednesday, Thursday 1:30pm-2:30pm
or by appointment

General Comments

In Chemistry 48 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).

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 Chemistry 47 will pay off as the course progresses. Topics that are especially important to review include:

Arrow Pushing: Arrow pushing is one of the most important "tools" 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 more acidic than alcohols. 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: Knowledge of the relative electronegativities 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 we covered in Chem. 47.

Nomenclature: I will assume you know 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. In my view, it is more important that you be able to draw a structure from a given name than write a name for a given structure.

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 problem reinforce the new concepts and are the only way to test your understanding of the material. There are many organic chemistry textbooks in the library and they all cover similar material. Work problems in other books once you have finished the problems in our book.
- 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.
- 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.
- Ask questions! Come to 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: Your course grade will be based on on-line homework assignments, quizzes, three examinations, a cumulative final examination, and your laboratory grade. (**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).

Lab	20%
Quizzes	10%
Online Homework	5%
3 Midterm Exams	45%
Cumulative Final	20%

Extra Credit: *BACON: Biology and Chemistry Online Notes and Tutorials*
'BACON' tutorials are a handy resource created by students and faculty at UCLA that are designed to help connect the wonders of organic chemistry to medicine, other aspects of real life, and even pop culture.

You will have 9 BACON tutorials available this term. The first 3 will serve to review content you learned previously, while the other 6 will correlate to new material you learn in this course. Each time you complete a BACON tutorial, you will also complete a brief multiple choice post-BACON quiz (*the quiz will be built into the tutorials*). For each tutorial you complete with a quiz grade of at least 75% you will earn 1 additional exam point.
To create your account visit bacon.chem.ucla.edu and click 'Sign Up'. Follow the instructions and then register for the appropriate course. The Course Pin number is **snail!!048**

The BACON system is simple and automated. You will receive emails when tutorials become available, in addition to reminders if you have not completed a tutorial as a deadline approaches.
The Department of Chemistry at the University of Vermont has decided to pre-pay the typical student fee for using BACON, so it will be available to you at no charge! Thanks Professor Landry!

On-line homework: Due each week by Thursday at 11:55 PM. No homework will be assigned the week after an exam. No homework grades will be dropped.

Standardized Exam: To assess student learning over this yearlong course sequence the ACS standardized exam will be given during your normal laboratory time on May 1. If you choose to, you may use the grade you obtain on this exam as your final exam grade.

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.

Midterm Dates:

Thursday February 15	6:00 P.M.-8:00 P.M.
Thursday March 22	6:00 P.M.-8:00 P.M.
Thursday April 19	6:00 P.M.-8:00 P.M.

Exam Location: Kalkin 003

Final Exam Date:
Date, time and place: May 7th, 7:30am(!) – 10:15am – Kalkin 003

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.

Outline of Readings

NOTE: The following two chapters cover material you will see in CHEM 052. *However, you will be responsible for knowing this material for our class*. We will work some practice problems in class and in lab, but your primary introduction to this material will occur in CHEM 052:

Chapter 12: Introduction to spectroscopy. IR and MS

All sections (12.6C will not be covered in depth)

Chapter 13: Nuclear Magnetic Resonance Spectroscopy

Sections: Read 12.1 first 13.1-13.7, 13.9-13.11

Problems: 3, 6-9, 10-12, 13-21, 22, 24-28, 31-37, 39-48, 51-59, 62

Chapter 10. The Chemistry of Alcohols and Thiols

Sections: 10.1-10.6 (more complicated than it needs to be), 10.7, 10.11, 10.12

Problems: 3-17, 19-21, 23-26, 28, 30-31, 38-40, 45, 47-51, 57, 59, 67, 68

Chapter 11: The chemistry of ethers, epoxides, glycols and sulfides (~3 Lectures)

Sections: 11.1, 11.2, 11.4, 11.3, 11.5, 11.6, 11.8, 11.10

Problems: 1-28, 32, 38-40a,b,d, 44-45c-j, 46, 48, 50, 51, 53-60, 61a-c,e-k, 62-65, 69, 70, 72, 74, 77, 79, 80

Chapter 14: The chemistry of alkynes. (~3 lecture)

Sections: 14.1-14.3 (read yourself), 14.4-14.8, 18.2 (p. 882)

Problems: 7-14, 18-25, 26, 27, 29, 31, 33-35, 38-40, 42-47a-e

Chapter 19: The chemistry of aldehydes and ketones. Carbonyl addition reactions (~4 lectures)

Sections: 19.1-19.4 (review), 19.5-19.7, 19.8-19.9 (review), 19.10-19.14

Problems: 12, 14-20, 22-31, 33, 34, 36-38, 40-45, 48, 49, 52-56, 62-65, 69

Chapter 20: The chemistry of carboxylic acids (~2 lectures)

Sections: 20.1-20.4 (review), 20.6-20.10

Problems: 8-16, 18-24, 27a-f, 28a,c,d, 31-34, 36-38, 42, 46, 47a-c,f-i, 48, 50a-f, 53

Chapter 21: The chemistry of carboxylic acid derivatives (~5 lectures)

Sections: 21.1-21.5 (review), 21.6-21.11

Problems: 1, 8-12, 14-16, 18, 20, 22, 24-28, 32, 33a-d,g-h, 36-39a, 40, 41, 43, 44, 47, 49, 50, 54, 56a-f,h, 57, 58

Chapter 22: The chemistry of enolate ions, enols and α,β-unsaturated carbonyls (~7 lectures)

Sections: 22.1-22.4, 22.6-22.12

Problems: 1, 3-8, 11, 14a,b, 15, 17-23, 25-31, 35-37a, 38, 40, 41, 43, 46-49, 51-53, 55a-g, 56a-e, 57a,b, 60, 64-66, 70-72, 74, 75a, 78-83, 87, 88a,b,d-k, 90, 91a-d,g, 92, 95

Chapter 15: Dienes, resonance, and aromaticity (~4 lectures)

Sections: 15.1-15.4, 14.6 (review), 14.7

Problems: 13-24, 36-40, 42-44, 46-48, 61-65, 68, 74, 76, 79, 80-84

Chapter 16: The chemistry of benzene and its derivatives: (~4 lectures)

Sections: 16.1-16.6, 18.1 (p. 880), 18.3 (p. 883), 18.4 (p. 885), 18.9 (p. 925)

Problems: 12-27, 30-32, 35, 36, 39, 40, 43-46, 48, 53-55, 61-63, 65

Chapter 17: Allylic and benzylic reactivity: (~1 lecture)

Sections: 17.5

Chapter 27: Amino acids, peptides and proteins (~2 lecture)

Chapter 23: The chemistry of amines (~1 lecture)

Chemistry 48 Laboratory

Text: Ault, "Techniques and Experiments for Organic Chemistry" 6th Ed., University Science Books, 1998.

General Considerations:

Read the entire chapter/handout before doing the experimental work. The experiments designated within each chapter describe the procedures that you will actually carry out in the laboratory.

Date	Experiment	Ault Experiment # or Handout	Ault Page
Jan 23	Check-in		
Jan 30	Generation and Reaction of an Organometallic Compound Part 1	Handout	
Feb 6	Spectroscopy Boot Camp	Handout	
Feb 13	Generation and Reaction of an Organometallic Compound Part 2	Handout	
Feb 20	Biodiesel	Handout	
Feb 27	Vanillin oxime from vanillin	E58	490
Mar 6	No Lab (Town Meeting Day)		
Mar 13	No Lab (Spring Break)		
March 20	Prep trans,trans-1,4-diphenylbutadiene	E71	524
March 27	Prep of methyl salicylate: oil of wintergreen	E77	538
April 3	Tetraphenylcyclopentadienone	E95	595
April 10	Diels-Alder Reaction	E66	508
April 17	Nitration of methyl benzoate	Handout	
April 24	Super Critical CO_2 Extraction of Limonene Check-out	Handout	
May 1	ACS Standardized Exam		