

Syllabus for CHM 5050 - 021
Organic Chemistry for Natural Science Teachers
Summer 2006

Course Description: CHM 5050 is a course designed with two broad goals – to provide high school teachers with a basic understanding of the principles of organic chemistry, and to carry out laboratory experiments to demonstrate these principles. The course is assigned 3 hours of credit.

Prerequisite: Two semesters of college chemistry or permission of instructor.

Course Goals: (1) Learn the basic principles of organic chemistry, and develop critical thinking methods for evaluation of organic reactions and compounds.
(2) Show how organic chemistry pervades every nuance of modern living.
(3) Complete organic chemistry experiments to supplement the lecture material.

Class Meeting: 12:40 p.m. – 2:45 p.m.. Mon, Weds, Fri
Phys. Sci. Bldg. 4020 (lecture)
Phys. Sci. Bldg. 4050 (lab)

Instructor: Dr. Ed Treadwell
Office: Phys. Sci. Bldg. Room 4450
Phone: 581-6229 E-mail: cfemt@eiu.edu
Office Hours: Mon. and Fri. 10:00 – 11:00 a.m.
Tues. 12:00 – 1:00 p.m.
Other hours as available or by appointment.

Materials: “Introduction to Organic Chemistry, Second Edition” by Brown
“Study Guide and Problems Book, Second Edition” by Benson, Iverson, & Iverson
“Organic Chemistry”, 6th edition by John McMurray
“Study Guide and Solutions Manual for McMurray’s Organic Chemistry” by Susan McMurray

Course Policies:

- (1) Attendance is expected but neither taken nor graded. I expect that the class will move very fast and each day will cover a fair amount of material. For absences on days in which laboratory experiments are performed, lab make-ups will only be granted for extremely good excuses. For absences on days where quizzes/exams are given, make-up quizzes/exams will not be given without a valid excuse as determined by the instructor.
- (2) Late assignments (both lab reports and class assignments) will incur a 10% per day late penalty. Assignments are due by 12:45 p. m. on the predetermined date.
- (3) For laboratory experiments, the safety rules as provided in the lab manual will be strictly enforced. Students will not be allowed in the lab without proper safety goggles.
- (4) You will be charged for any breakage of glassware in the laboratory.
- (5) Reading assignments and textbook homework problems to accompany the lecture notes are provided on pages 4 - 5 of the syllabus, but neither activity will be graded.
- (6) Quizzes and due dates for assignments will be announced in class at least a week in advance. You are responsible for these announcements irregardless of whether or not you are present on the day of the announcement.
- (7) There will be a comprehensive final exam as stated on page 2 of the syllabus.
- (8) If you have a documented disability, please contact me to discuss academic accommodations.
- (9) All aspects of the student conduct code are expected to be embraced and exemplified.

Course Format:

The course format is malleable and will depend to some extent upon the desires of the participants, but initially the format is envisioned as follows. Lectures will be given each day, covering 4 discrete units:

Unit 1 – Bonding and Structure of Organic Compounds, Acidity of Organic Compounds

Unit 2 – Functional Groups and Nomenclature

Unit 3 – Physical Properties, Conformational Analysis, and Stereochemistry

Unit 4 – Reactions and Mechanisms

(note that these units are not of equal length, and in particular Unit 4 is longer than any other Unit)

Some days (mostly Wednesdays), part of the class time will be devoted to simple laboratory experiments that demonstrate some of the techniques used in organic chemistry as well as incorporate the material covered in lecture. Before each lab, a brief pre-lab lecture will be given. It is in your best interest to read the lab you will be performing that day ahead of time. Each lab will have a “report” that will be due within a week of the lab, with the requirements and the exact due date to be announced the day the lab is started.

Part of the class time on Fridays will be devoted to lectures/discussions of “special topics” involving organic chemistry. Also part of the class time on Fridays will be available for discussions of how to implement the week’s lecture-material into high school courses.

There will be two exams and a comprehensive final exam, to be given and completed in class without the use of notes or textbooks. There will be several outside-of-class projects/homework assignments assigned.

Discussion and classroom participation are gladly encouraged. Please do not hesitate to drop by my office or contact me by email or phone with any questions you may have at any point.

Grading:

Point Distribution

Homework	170 points	(~32 % of total grade)
Exams	80 points	(~15 % of total grade)
Lab Reports (8 total @ 15 points each)	120 points	(~23 % of total grade)
Assigned Projects (total)	100 points	(~19 % of total grade)
Final Exam	60 points	(~11 % of total grade)
Point Total	530 points	

The standard grading scale will be employed – 90% or above for an “A”, 80 – 89.4% for a “B”, 70 – 79.4% for a “C”, 60 – 69.4 % for a “D”, and below 60% resulting in a “F”.

Reading Assignments

Two textbooks have been assigned for this course. The smaller book by Brown is a survey organic chemistry text, designed for a one semester course for non-chemistry majors. The bigger black book by McMurray is a standard organic chemistry text, designed for a two semester course for chemistry majors. In some cases, the survey book suffices but for other units a deeper coverage of the material is needed (hence the McMurray book).

For each unit/subunit, only one text will contain the assigned reading, and the reading sections can be found under the “Principle Reading” column. Please feel free to consult the alternate text for additional information/presentation as needed. Also note it would be to your benefit to read the appropriate sections before coming to class.

Approximate Course Schedule

Week	Monday	Wednesday	Friday
1 (June 12 – 16)	Unit I	<i>Exp 1</i>	
2 (June 19 – 23)	Unit II	<i>Exp 2</i>	
3 (June 26 – 30)	Unit III <i>Exp 3</i>	<i>Exam 1</i>	<i>Exp 4</i>
4 (July 3 – 7)		Unit IV <i>Exp 5</i>	
5 (July 10 – 14)		<i>Exp 7</i>	<i>Exam 2</i>
6 (July 17 – 21)		<i>Exp 8</i>	Final exam

Lab Experiments:

Laboratory experiments 1 – 2 will cover two techniques essential to experimental organic chemistry, while experiments 3 – 6 will be based on organic synthesis. Each lab is envisioned to require 1 hr to complete, though in certain cases the final analysis of materials prepared in one lab experiment will stretch into the next laboratory period. The procedures for the experiments, as well as a list of safety rules, can be found in the lab manual handed out on the first day of class.

<u>Experiment Number</u>	<u>Experiment Title</u>
1	Recrystallization
2	Chromatography
3	Preparation of Soap
4	Aspirin
5	tba
6	Aldol Condensation
7	Identification of Unknown
8	Polymer Synthesis

Suggested Reading Assignments and Homework Problems for CHM 5050.

Unit or Subunit	Principle Reading Textbook	Sections	Suggested Homework Problems
Unit I.			
Bonding/Structure of Molecules.	Brown	1.1 – 1.6	1.6, 1.7, 1.17, 1.22, 1.25, 1.26 (b, c, f, i, l), 1.30, 1.34, 1.35, 1.39, 1.44, 1.47, 1.48, 1.56
Acids and Bases	Brown	2.1 – 2.5, 9.4B 10.4, 12.4A	2.1, 2.3, 2.8, 2.9, 2.12, 2.15, 2.16, 2.20, 9.2, 9.15, 10.5, 10.17, 10.18, 10.21, 12.2, 12.21
Unit II.			
Functional Groups	McMurray	3.1	3.1, 3.23, 3.27
Nomenclature	McMurray	Appendix (3.4, 6.3, 15.2, 17.1, 18.1, 19.1, 20.1, 21.1, 24.1)	3.9, 3.13, 3.30, 3.34, 3.40, 6.27, 6.28, 6.43, 15.17, 15.18, 17.1, 17.2, 17.24, 18.25, 18.26, 19.25, 19.27, 20.17, 20.18, 21.36 21.36, 24.24, 24.25
Unit III.			
Physical Properties – Attractive Forces	Brown	3.8, 8.3, 10.3, 11.3, 12.3	3.11, 3.36, 8.17, 8.18, 8.22, 10.14, 10.15, 12.16
Alkene Stability	McMurray	6.7	6.13
Aromaticity	McMurray	15.3 – 15.10	15.23
Conformational Analysis. . . .	McMurray	4.1 – 4.6, 4.9 – 4.13	4.25 (a,b), 4.27, 4.33, 4.35
Stereochemistry	McMurray	9.1 – 9.9, 9.11 – 9.14	9.35, 9.36, 9.41, 9.47, 9.48, 9.51, 9.52, 9.53
Unit IV.			
Overview of Reactions. . . .	McMurray	5.1 - 5.4 5.6 – 5.10	5.1, 5.4, 5.20, 5.22, 5.23, 5.24, 5.38
Reactions:			
Alkenes	Brown	6.1, 6.3, 6.4B, 6.5 (6.6)	6.2, 6.3, 6.5, 6.11, 6.13, 6.15, 6.16, 6.17, 6.21, 6.29, 6.31
Alkyl Halides	Brown	7.2 – 7.7	7.5, 7.16, 7.17, 7.19, 7.22, 7.23, 7.25, 7.26, 7.29, 7.30
Alcohols	Brown	8.4	8.8, 8.33, 8.34, 8.36, 8.37
Aldehydes and Ketones.	Brown	11.4 – 11.10	11.20 (skip b), 11.21, 11.26, 11.27, 11.29, 11.32, 11.38, 11.39
Carboxylic Acids/ Derivatives	Brown	12.5 – 12.6 13.2 – 13.5, 13.8	12.27, 12.30 13.13, 13.19-13.21, 13.26, 13.27, 13.29
Enolate Chemistry	Brown	14.1 – 14.3A	14.2, 14.12, 14.13, 14.15, 14.17, 14.25, 14.26, 14.27
Aromatics	Brown	9.6 – 9.8	9.7, 9.22, 9.24, 9.25 9.26, 9.28

Useful References for Teaching Organic Chemistry:

ONLINE

American Chemical Society web page –

<http://www.chemistry.org/portal/Chemistry>

Home page presents a “molecule of the week” with structure and text. There is a link to “Educators and Students”, and some useful items to be found here are:

Wondernet – an ensemble of chemistry experiments/demonstrations

ChemMatters - the ACS newspaper for high school students; has a separate teachers guide

The Virtual Chemistry Club – touted as “THE chemistry site for high school students”. contains multiple links, including product reports, “chemistry mysteries” (real-life use of chemistry to solve crime/unexpected phenomena), career descriptions for different types of chemists, puzzles, activities, and more. Also has purchasable materials.

<http://pubs.acs.org/cen/whatstuff/stuff.html>

The ACS puts out a weekly magazine about chemistry, and the link given above goes to a page titled “What’s that stuff” that gives descriptions of a few common household items

USDA Consumer Drug Information Page

<http://www.fda.gov/cder/consumerinfo/default.htm>

Provides limited list of medicines that when clicked upon give a summary for the drug. Each summary contains a link to the drug’s approved label and patient information, which usually contains the chemical structure of the compound.

MEDLINEplus (national library of medicine) website –

<http://www.nlm.nih.gov/medlineplus/druginformation.html>

Searchable database for prescription/over the counter medicines. Gives the trade-name for the chemicals in the medicine (ie, Prozac pills contain fluoxetine). Limited usefulness.

Mayo Clinic website

<http://www.mayoclinic.com>

Has easy to understand descriptions of diseases, ailments, drugs, and treatments for the above.

Household Products database (maintained by National Institute of Health)

<http://householdproducts.nlm.nih.gov/products.htm>

Gives detailed safety information, as well as a list of the ingredients, for many exact brands of household products (includes information on automotive products, lawn products, and pet products as well)

Journal of Chemical Education web page –

<http://jchemed.chem.wisc.edu/Journal/index.html>

Unfortunately, most of this material is restricted to subscribers. There is a limited search engine for journal articles, and also listings of software and books that can be purchased.

The Chemical Educator –

<http://chemeducator.org/>

As above, this is a journal where access is restricted to subscribers. In contrast to JCE, most of the experiments are geared towards the college level, but CE does have some rather interesting articles on chemical history.

MSDS web pages –

<http://msds.pdc.cornell.edu/msdssrch.asp>

<http://siri.uvm.edu>

Both of these allow for searching for the MSDS (material safety data sheets) of specific chemicals.

These are very useful in determining the dangers of working with specific chemicals.

Periodic table web pages –

<http://www.webelements.com/webelements/elements>

<http://www.chemsoc.org/viselements/>

Under Eastern Illinois's Chemistry Department webpage (<http://www.eiu.edu/~eiuchem>) can be found a link entitled "Chemistry Links Around the World"

BOOKS

The Merck Index, 13th ed. O'Neil, M. J. (ed.) Merck Research Laboratories, Whitehouse Station, NJ, 2001. ISBN 0911910-13-1.

Book prepared regularly by the Merck Company. Lists chemicals alphabetically, giving structure, references, physical data, limited activity description. Has index that allows searching by trade names instead of chemical names (ie, Prozac and Roundup are listed in index). New edition expensive (\$60), but older editions are still very useful (and cheaper).

The Organic Chem Lab Survival Manual. A Student's Guide to Techniques. 5th ed. Zubrick, J. W. John Wiley and Sons, New York, NY, 2001. ISBN 0-471-38732-0.

An extremely useful and tongue-in-check resource book that covers both theoretical and experimental details of all common organic laboratory procedures. (paperback)