

Course Description - This course is designed to introduce the student to the chemistry of alkanes, alkenes, alkynes, and alkyl halides. The approach will be both mechanistically and synthetically oriented. The laboratory component of this course will involve the basic techniques of synthetic organic chemistry.

*Faculty*

Dr. Chriss McDonald

*Responsibilities*

lectures, lab, recitations

*Office*

HBC 233

321-4186 (w), 998-8647 (h, call any time before 10 pm), 506-9440 (c), or e-mail (mcdonald@lycoming.edu)

Prerequisite

Successful completion of Chem 111

Texts, etc.

- Organic Chemistry, 9e* by McMurry<sup>#</sup>
  - Chemistry 220/221 Lab Manual*, by McDonald and Bendorf<sup>#</sup>
  - Bound laboratory notebook by Freeman<sup>#</sup>
  - Lab safety glasses<sup>#</sup>
  - Calculator (add, subtract, multiply, divide, logs)
  - Model kit.....<sup>#</sup>
  - Lab deposit, \$10 at lab check-in, **cash only** (refundable upon checkout)
- <sup>#</sup>available at the bookstore

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 rules;
4. Recognize conformational isomers and stereoisomers;
5. Recognize the impact that the three-dimensional nature of molecules has on chemical behavior;
6. Predict products and propose mechanisms for reactions of alkenes; alkynes, and alkyl halides;
7. Propose multi-step syntheses of small molecules;
8. Use infrared spectroscopy, polarimetry, and physical properties to

- characterize molecules of known structure and identify molecules of unknown structure;
9. Demonstrate proficiency with standard organic laboratory techniques for the synthesis and purification of organic compounds.

#### Department of Chemistry Learning Goals That are Supported by Organic Chemistry I

1. Exhibit proficiency in the major sub-disciplines of chemistry;
2. Perform wet laboratory techniques that are appropriate to organic chemistry;
3. Understand and use modern chemical instrumentation
4. Exhibit integrative problem-solving skills, such as experimental design, data manipulation, and data interpretation.

#### This course supports the Mission of the College

<http://www.lycoming.edu/aboutLycoming/mission.aspx>, (accessed 8/7/17) by developing critical thinking skills and exploring scientific traditions.

Learning Differences and Disabilities Lycoming College provides academic support for students who have been diagnosed with learning, physical, and psychological disabilities. If you have a diagnosed disability and seek academic accommodations, please contact Dean Jilliane Bolt-Michewicz (Sophomore Dean and Coordinator of Services for Students with Disabilities). Dean Bolt-Michewicz will help you arrange for academic accommodations in the classroom. You may contact her as follows:  
[michewicz@lycoming.edu](mailto:michewicz@lycoming.edu); 321-4050; Snowden Library, 3rd floor, ARC.

#### Course Format

*Lectures:* MWF, 9:00-10:05, attendance will be taken daily.

*Evening review session:* Problem solving sessions will be built into class time. We will also have a weekly help session in the early evening.

*Assigned homework:* There will be two assignments per topic. One from the book and a homemade one that will be handed out at the help session. These will not be graded but I expect you to do both. Homework will be discussed during the help sessions. Obviously the homework assignments will be a crucial study element for quizzes and tests. Answer keys will be posted on Moodle.

*Moodle-based supplements:* There is a Moodle site for this course which includes homework keys (primarily from the text), extra problems keys (homemade problems), and study guides.

*Other items of value include:*

Organic Chemistry as a Second Language, Klein, David (available from Amazon).

<https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/intro1.htm> / (accessed 8/7/17, an alternative web-based text).

<http://www.sigmaaldrich.com/united-states.html> (accessed 8/7/17, useful for looking up lab data).

**Labs: Prelab is in 220. T 7:45 -11:35 (220M), Th 7:45 – 11:35 (220Q).** Be on time and be prepared!!!!

*Calculators, Cell phones, and Communication devices:* You will need a simple calculator for lab. You will not need one for class. The use of graphing calculators, cell phones, and any web-enabled devices are banned from class.

### Grading

Your grade will be based on the total number of points you obtain out of a possible 605. Assignment of letter grades is based on the following scale: A 666 -599 (100 - 90%), B 598 – 533 (89 - 80%), C 532 - 466 (79 - 70%), D 465 - 400 (69 - 60%), F 399 - 0 (59 - 0%). The points will be distributed as follows:

biographical info	05 points
quizzes	70 points
exams 1-3	300 points <sup>@</sup>
final exam	121 points <sup>@*</sup>
<u>laboratory</u>	<u>170 points</u>
total	666 points

<sup>@</sup>Exams will contain at least 25% of problems from homework assignments and 25% from help sessions.

<sup>\*</sup>A higher score on the final exam can be used to replace one lower score from exam 1-3.

As always you will have the opportunity to obtain bonus points through attendance at our colloquium series. Assuming you stay for the whole show and mind your manners you will receive 3 points per speaker. You may also receive up to 6 bonus points by writing a paper on a topic that we have mutually agreed upon (2 - 3 pages, typewritten, double spaced, with a minimum of three bibliographic sources). Any extra credit papers must be turned in by **Friday 12/8**. The ceiling on bonus points is 12.

### Guidelines for Attending Colloquium

- i. Be on time.
- ii. The speaker has expended a lot of effort to prepare for the talk. Be attentive and polite.
- iii. If you can't stay for 45 minutes for an internal speaker or 60 minutes for an external speaker, don't come (please do not ask the speaker how long the talk will last).
- iv. Realize that questions for the speaker at the end is part of the talk and you will be expected to stay for that as well.

### Class Etiquette – The $\pm 5$ Policy

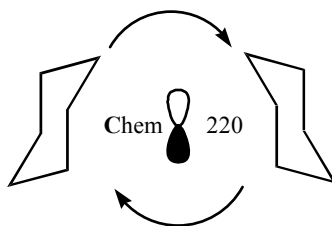
I'm not a cop. I won't call people out for bad behavior (unless it is disruptive). My policy is that appropriate behavior (being at class on time, paying attention, contributing to the discussion, maintaining a positive attitude...) will be rewarded with up to 5 extra points. Bad behavior (the opposite of the stuff listed above, fiddling with cell phones, not showing up, leaving class in the middle or early.....) could cost a student up to 5 points.

### A Word About Learning Chemistry

Studying chemistry is hard work for most people (this is certainly true for me). I would recommend that you work on the lecture material at least one hour per day outside of class for starters. Once you see how things are going this amount can be adjusted as needed (I suggest a significant increase in study time prior to an exam). If you are having trouble, make sure and come and see me. I'm easy to talk to and will do whatever I can to help you. You will be responsible for all of the material listed on the following schedule for the indicated exams and quizzes. It is not sufficient to learn the material from the lecture alone. You are expected to read and think about the material prior to the lecture. We must necessarily cover a large amount of material so our pace must be geared towards those who are ready to learn. The hour exams will be somewhat cumulative in the sense that we need to know the earlier material to comprehend the latter.

### Policy on Attendance

Attendance at quizzes and exams is mandatory. Makeups will be administered only if I deem the reason for absence to be legitimate **and I am made aware of the absence beforehand**. Each documented, unexcused lecture absence beyond the first two will cost you one point from your total.



“Organic Chemistry nowadays almost drives me mad. To me it appears like a primeval tropical forest full of the most remarkable things, a dreadful endless jungle into which one does not dare enter, for there seems no way out.”

Freidrich Wohler, 1835  
(the slayer of the vital force theory)

<u>week/ date</u>	<u>topic</u>	<u>text</u>	<u>quiz/exam</u>
8/28	hello organic chemistry!	1 (p. 1-3)	
<b>1</b> 8/30	ionic, covalent bonds, Lewis structures	1.1,4,5	
9/01	formal charge, resonance, functional groups	2.1-4, 3.1	
9/04	introductory molecular orbital theory	1.1-3,5	
<b>2</b> 9/06	orbital hybridization	1.6-11	
9/08	as above	1.6-11	<b>Q1</b>
9/11	naming/drawing alkanes	1.12,3.2-4	
<b>3</b> 9/13	alkane properties, cycloalkanes	2.12,3.5,4.1,2	
9/15	alkane conformational issues	3.6-7	<b>Q2</b>
9/18	ring strain, cycloalkane conformers	4.3-8	
<b>4</b> 9/20	acid-base reactions	2.7-10, 24.3	
9/22	<b>EXAM 1</b>	-	<b>E1</b>
9/25	curved arrow formalism in acid-base rxns	2.4-6,11	
<b>5</b> 9/27	classification of organic reactions	6.1-6	
9/29	polar reaction examples	6.1-6	
10/02	basic thermodynamics/kinetics	6.7-10	
<b>6</b> 10/04	structure/nomenclature of alkenes	7.3,4,6	
10/06	addition of HX to alkenes	7.7-10	<b>Q3</b>

	10/09	as above + cation rearrangements	7.7-11	
<b>7</b>	10/11	addition of X <sub>2</sub> , halohydrin formation	8.2-3	
	10/13	oxymercuration, hydroboration	8.4,5	<b>Q4</b>
	10/16	other alkene rxns	8.6-8	
<b>8</b>	10/18	alkyne nomenclature/structure	9.1,2	<b>Q5</b>
	10/20	long weekend	-	
	10/23	alkyne HX, X <sub>2</sub> additions	9.3	
<b>9</b>	10/25	alkyne hydrations, reductions	9.4,5	
	10/27	<b>EXAM 2</b>	-	<b>E2</b>
	10/30	enantiomerism	5.1,2	
<b>10</b>	11/01	optical activity	5.3,4	
	11/03	sequence rule	5.5,7.5	
	11/06	diastereomers	5.6-9	
<b>11</b>	11/08	stereochemical analysis of selected rxns	5.12,8.12,13	
	11/10	infrared spectroscopy: theory	12.5,6	<b>Q6</b>
	11/13	infrared spectroscopy: interpretation	12.7,8	
<b>12</b>	11/15	infrared spectroscopy: interpretation	12.7,8	
	11/17	<b>Exam 3</b>	-	<b>E3</b>
	11/20	kinetics/ stereochemistry of substitution	11.1	
<b>13</b>	11/22	Tgiving		
	11/24	Tgiving		
	11/27	the S <sub>N</sub> 2 rxn	11.1-3	
<b>14</b>	11/29	the E2 rxn	11.7-9	<b>Q7</b>
	12/01	the S <sub>N</sub> 1 rxn	11.4,5,12	
	12/04	the E1 rxn, summary of substitution and elimination	11.10-12	
<b>15</b>	12/06	alkylation of alkyne conjugate bases	9.7-9	
	12/08	multistep syntheses, pheromones	9.7-9	

<b>Final Exam TBA</b>
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Tell me about yourself ..... Please include the following info for full credit –

1. Name and what you like to be called;
  2. Major (and note whether it is intended or actually declared);
  3. Minor (and note whether it is intended or actually declared);
  4. Fr., So., Jr., Sr.;
  5. 4 digit code for the posting of grades;.
  6. Tell me two interesting/funny things about yourself;
  7. Tell me about your background in chemistry.
- 
8. List ALL of the times that work with your schedule for help session:

6 pm Tuesday      7 pm Tuesday      6 pm Wednesday      7 pm Wednesday

Tell me about yourself ..... Please include the following info for full credit –

1. Name and what you like to be called; *Chriss McDonald, you may call me Chriss, Dr. McD, or Dr. McDonald.*
2. Major (and note whether it is intended or actually declared); *As an undergrad (late 70's) I was actually a medical technology major.*
3. Minor (and note whether it is intended or actually declared); *An unofficial one in history.*
4. Fr., So., Jr., Sr.; *Very senior.*
5. 4 digit code for the posting of grades; *N/A.*
6. Tell me two interesting/funny things about yourself; *I am rediscovering hobbies I haven't done in 15 years (model railroading and landscape painting)*
7. Tell me about your background in chemistry. *I thought chemistry was merely OK until I got to organic, went bonkers over that. Went to grad school at Miami of Ohio in synthetic organic chemistry. Still learning lots of cool stuff about organic chemistry. I'm interested primarily in the development of new synthetic methods. Specifically the development of new strategies for carbon – carbon bond formation.*

