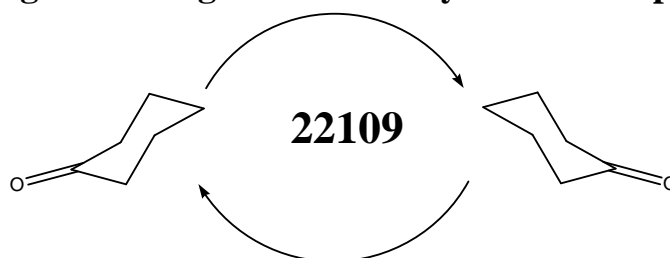


Lycoming College

Organic Chemistry II

Spring 2009



Course Description This course is designed to introduce the student to the chemistry of alcohols, arenes, and carbonyl compounds. The approach will be both mechanistically and synthetically based. The spectroscopic tools used to discern organic structure will also be examined in some detail. The lab portion of the course will focus on synthetic organic chemistry, qualitative organic analysis, and mechanism. **We will be building on some key concepts from Chem 220, such as, Lewis structures, formal charges, basics of polar reaction mechanisms, substitution/elimination pathways, and IR interpretation.**

Faculty Dr. Chriss E. McDonald, (work phone 321-4186, home 998-8647 (call up until 10 pm), email [mcdonald@lycoming.edu](mailto:mcdonald@lycoming.edu)), no specific office hours but I'm usually around.

Prerequisite

Completion of Chem 220 with a grade of C- or better.

Text

Organic Chemistry 7e, John McMurry

Course Objectives

Upon completion of this course each student should be able to:

1. Use mass spectrometry, infrared spectroscopy, and NMR spectroscopy to elucidate the structure of unknown molecules.
2. Identify potential sites of chemical reactivity based on molecular structure.
3. Differentiate between aromatic and antiaromatic, and nonaromatic molecules.
4. Predict products and propose mechanisms for reactions involving alcohols, dienes, arenes, and various carbonyl compounds.
5. Propose multistep syntheses of small molecules.
6. Demonstrate proficiency with standard wet chemical and spectroscopic techniques as they apply to synthetic organic chemistry.

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 sites of value include:

<http://chemfinder.cambridgesoft.com/> (useful for lab writeup info),

[www.chem.ucla.edu/~webspectra/](http://www.chem.ucla.edu/~webspectra/) (accessed 12/2/08, spectral interpretation),

[www.mdli.com](http://www.mdli.com) (accessed 12/2/08, a FREE chemical drawing program!!)

*Exams:* Exams 1-3 will be hour exams on the indicated days. The final will be an American Chemical Society standardized, multiple choice exam (cumulative over the whole of organic chemistry).

*Labs:* Similar to last semester. **Prelab is in G-41. T 7:45 -11:35 (221M), T 1:00 – 4:50 (221N), Th 7:45 – 11:35 (221Q).** 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, PDA's, 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 605 -544 (100 - 90%), B 543 – 484 (89 - 80%), C 483 - 423 (79 - 70%), D 422 - 363 (69 - 60%), F 362 - 0 (59 - 0%). The points will be distributed as follows:

quizzes	70 points
exams 1-3	300 points
final exam	100 points (cumulative ACS exam)*
<u>laboratory</u>	<u>135 points</u>
total	605 points

\*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 4/24. The ceiling on colloquium 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 (7 days/week) 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. The good student will read the text, read the notes, review concepts from Chem 220 that are fuzzy (see below), make lists of questions to ask me, and generally stay on top of things. 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 cumulative in the sense that we need to know the earlier material to comprehend the latter. *Speaking of the cumulative nature of organic chemistry, here is a list of Chem 220 topics that significantly impact our studies in Chem 221. I strongly suggest these topics be reviewed prior to studying the relevant new material.*

<u>220 Topic</u>	<u>Text location</u>	<u>221 Topic</u>	<u>Text location</u>
Lewis structures	SM	all mechanistic discussions	ubiquitous
functional groups	Chp 3	all synthetic discussions	ubiquitous
curved arrow notation	5.4,5, SM	all mechanistic discussions	ubiquitous
formal, partial charges	2.1, SM	all mechanistic discussions	ubiquitous
E <sup>+</sup> addition to alkenes	6.8-10	E <sup>+</sup> aromatic substitution	Chp. 16
S <sub>N</sub> 2/S <sub>N</sub> 1	Chp. 11	alcohols/ethers/carbonyls	Chps. 17,18
infrared spectroscopy	Chp. 12	NMR spectroscopy	Chp. 13

### Attendance policy

Attendance at quizzes and exams is mandatory. Makeups will be administered only if I deem the reason for the absence to be legitimate and I am made aware of the absence

beforehand!!

### CHEM 22109 CHRONODYNAMICS

Week	Date	Topic	Text	Q/E
<b>1</b>	1/12	introduction/radicals	<b>5.2,3,8</b>	
	1/14	representative radical chains	<b>7.10,11 10.3-5</b>	
	1/16	mass spectrometry	<b>12.1-3, SM*</b>	
<b>2</b>	1/19	NMR theory	<b>13.1-3,8,9, SM</b>	
	1/21	chemical shift and coupling	<b>13.10,11,13</b>	
	1/23	proton NMR problems	-	<b>Quiz 1</b>
<b>3</b>	1/26	carbon NMR	<b>13.4-7, SM</b>	
	1/28	physical/spectroscopic properties of alcohols	<b>17.1,2,11, SM</b>	
	1/30	substitution/elimination rxns of alcohols	<b>17.6, 18.2</b>	<b>Quiz 2</b>
<b>4</b>	2/02	redox chemistry of alcohols	<b>17.7</b>	
	2/04	ethers	<b>18.1,2</b>	
	2/06	Exam 1	-	<b>Exam 1</b>
<b>5</b>	2/09	epoxides	<b>18.5,6</b>	
	2/11	diene structure	<b>1.7-11, 14.1</b>	
	2/13	electrophilic additions to dienes	<b>14.2-4</b>	
<b>6</b>	2/16	the Diels-Alder rxn (finest in org. chem.)	<b>14.4,5</b>	
	2/18	intro to arenes	<b>15.1-2, SM</b>	
	2/20	Huckel's rule and arene spectroscopy	<b>15.3-8</b>	<b>Quiz 3</b>
<b>7</b>	2/23	electrophilic aromatic substitution (EAS)	<b>16.1-3</b>	
	2/25	EAS on substituted arenes	<b>16.4,5</b>	
	2/27	EAS on disubstituted arenes, synthesis	<b>16.6</b>	<b>Quiz 4</b>
	3/02 – 3/06	“Spring” Break Week		
<b>8</b>	3/09	substituent modifications and multisteppers	<b>16.9-10, 24.8</b>	
	3/11	aldehyde/ketone (A/K) intro, synth of A/K	<b>19.1,2,14, SM</b>	
	3/13	Exam 2	-	<b>Exam 2</b>
<b>*SM = Supplemental Materials pamphlet</b>				
<b>9</b>	3/16	addition of H <sup>-</sup> , R <sup>-</sup> to A/K	<b>19.3,4,7, 17.4,5</b>	
	3/18	addition of protic nucleophiles to A/K	<b>19.5,6,8, 10</b>	
	3/20	as above	as above	

<b>10</b>	3/23	A/K synthetic and mechanistic problems	<b>Chp. 19</b>	
	3/25	the Wittig rxn	<b>19.11</b>	
	3/27	carboxylic acids	<b>20.1-2,5 7,8,10, SM</b>	<b>Quiz 5</b>
<b>11</b>	3/30	carboxylic acid derivatives	<b>21.1,10, SM</b>	
	4/01	nucleophilic acyl substitution (NAS)	<b>17.4,5, 21.2-7</b>	
	4/03	addition of $H^-$ , $R^-$ to acid derivatives	as above	<b>Quiz 6</b>
<b>12</b>	4/06	RC(O)Z synthetic problems		
	4/08	Exam 3		<b>Exam 3 (W)</b>
	4/10	Good Friday	-	
<b>13</b>	4/13	keto-enol isomerism	<b>22.1</b>	
	4/15	enol-based rxns	<b>22.2-4</b>	
	4/17	generation of enolates	<b>22.5,6</b>	
<b>14</b>	4/20	alkylation of enolates ( $S_N2$ )	<b>22.7,8</b>	
	4/22	addition of A/K to enolates	<b>23.1-7</b>	<b>Quiz 7 (W)</b>
	4/24	NAS of enolates, conjugate addition	<b>23.8-10</b>	
	4/27	<b>final exams</b>		

# ORGANIC CHEMISTRY

## LAB SCHEDULE SPRING 2009

The lab component of this course is worth 135 points. Except for the three week Qualitative Organic Analysis lab, all of the lab writeups will be worth 15 points each.<sup>#</sup> The QOA lab will be worth a whopping 30 points. The week 2 quiz on IR, stoichiometry, and significant figures will be worth 15 points. Many of the experiments will be inquiry-based and will impact what we do in lecture as well. **The penalty for late lab reports is 5% per school day. Lab reports cannot be turned in after any have been returned.**

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

You will be expected to be on time, to read the experiment ahead of time, to perform the experiment in a safe manner, to keep your personal area and the common areas of the lab clean, and to be courteous to your labmates. Please refer to the poster within the lab for more details.

WEEK	DATES	TOPIC	ASSIGNED READINGS	WRITEUP DUE*
1	1/13,15	Radical Polymerization of Methyl Methacrylate, Check-in	Chp. 46A	1/27,29
2	1/20,22	The Attack of the Killer Protons on Carvone	Chp. 30	2/03,05
3	1/27,29	as above		
4	2/03,05	GC Analysis of an Isomeric Mixture Generated by E.A.S.	Chp. 37	2/17,19
5	2/10,12	The Nitration of Methyl Benzoate	Chp. 34	2/24,26
6	2/17,19	as above		
7	2/24,26	Qualitative Organic Analysis	Chp. 38	3/31,4/02
	3/03,05	<b>Spring Break</b>		

<sup>#</sup>The 15 point **lab quiz** will be during the week 2 reflux period.

**\*Writeups (STAPLED) will be due at the beginning of prelab on the indicated day.**

WEEK	DATES	TOPIC	ASSIGNED READINGS	WRITEUP DUE*
<b>8</b>	3/10,12	as above		
<b>9</b>	3/17,19	as above		
<b>10</b>	3/24,26	as above		
<b>11</b>	3/31,4/02	The Synthesis of Methyl Diantilis <b>or</b> V for Virstatin	handout <b>or</b> Chp. 45	part 1: 4/14,16
<b>12</b>	4/07,09	as above		
<b>13</b>	4/14,16	as above		part 2: final exam
<b>14</b>	4/21,23	as above, check-out		

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. Which times will work for you for our help session (circle all that work)?

Monday 7 pm      Tuesday 7 pm      Thursday 7 pm

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; a) I'm usually couch, almost always..... b) I take Naproxen and Ibuprofen as performance-enhancing drugs.
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. My research focus is on the development of new ligands for samarium diiodide (an important reducing agent in org chem)*



8. Which times will work for you for our help session (circle all that work)? *You tell me.....*