Lycoming College Chem 440 Fall 2014

Advanced Organic Chemistry

Course description - This course is designed to further your understanding of modern organic chemistry. The laboratory component of the class is meant as an introduction to typical experiments within the discipline.

Instructor - Dr. Chriss McDonald, phone: 321-4186 (work), 998-8647 (home, call up to 10 pm)
Email: mcdonald@lycoming.edu

Texts and other stuff

a. *no textbook per se, I will supply readings from the primary and secondary literature.*
b. Your 200-level organic chemistry text (McMurry)
c. Bound laboratory notebook by Freeman
d. Calculator (add, subtract, multiply, divide, logs, exponents),
e. Chem 220-221 lab manual (your old one, whichever year it happens to be)

Course objectives:

a. To understand how different experimental techniques are used to elucidate organic reaction mechanisms;
b. To become more familiar with the three main mechanistic classes (polar, radical, pericyclic) of organic reactions;.
c. To become familiar with more advanced laboratory techniques for physical and synthetic organic chemistry;
d. To understand the key issues involved in natural product synthesis.

Department of Chemistry learning goals that are supported by this course:

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

This course supports the Mission of the College

The mission of **L**ycoming **C**ollege is to provide a distinguished baccalaureate education in the liberal arts and sciences within a coeducational, supportive, residential environment.

Learning differences and disabilities

Lycoming College provides academic support for students who officially disclose diagnosed learning, physical and psychological disabilities. If you have a diagnosed disability and would like to seek accommodations, please contact Jilliane Bolt-Michewicz, Assistant Dean of Academic Services / Director of the Academic Resource Center. Dean Bolt-Michewicz will help you arrange for appropriate academic accommodations. She can be reached by calling 570-321-4050, emailing

michewicz@lycoming.edu, or visiting her office (Academic Resource Center, 3rd Floor of Snowden Library).

Course format
Lectures - MWF, 2:00 PM, HBC 215

Recitations - None scheduled, if you guys want some, let me know and we'll find a time to get together. We do have a few in class problem sessions scheduled. As always, questions are welcome at any time.

Assigned homework - problems designed to enhance your understanding and prepare you for testing situations. Some of these questions will be taken from the literature (which means you can go look up the answers!). A key will be posted immediately after class. No late homework will be accepted. There will also be individually assigned mechanistic problems for you to present in class.

Laboratory - 8:00 - 11:50 AM, Tuesday, in the *Swing Lab*, the labs will be designed to probe mechanistic problems in organic chemistry.

Exams - Exams will occur during the lab period of the indicated week. They should be both fun and challenging.

Colloquium – Almost all of our colloquia have some synthetic/mechanistic chemical content. Therefore a small portion of your grade is based on your attendance at colloquium. You must attend 7 colloquia to obtain full credit. If you are unable to attend colloquium due to a scheduling conflict, you may obtain the points by summarizing appropriate articles from the chemical literature. You should discuss this with me before begin summarizing articles.

Grading scheme

a. The final grade is based on the number of points obtained out of a possible 660 points. The points will be distributed as follows:

quizzes	45 points
mechanistic problem for each	10 points
exam 1	100 points
exam 2	100 points
exam 3	100 points
final exam (cumulative)	124 points
laboratory	130 points
homework	50 points
colloquium	21 points
total	**680 points**

b. Assignment of letter grades is based on the following scale: 680 -612 **A**, 611 - 544 **B**, 543 - 476 **C**, 475 - 408 **D**, < 407 **F**. I reserve the right to curve the grades in your favor if deemed appropriate based upon overall class performance and a qualitative assessment

of the difficulty of quizzes and exams. Also, if you score a higher *percentage* on the final exam than one of your hour exams, I'll replace the lower score with the higher (appropriately weighted). The assignment of the final grade is also influenced by attendance and class participation. This is especially true in the case of a student with a borderline average.

Policy on attendance for exams and quizzes Makeups will be administered only if I deem the reason for absence to be legitimate (illness, death in the family....). Absence due to transportation difficulties is not considered legitimate.

Chem 44014 Schedule

Week	Date	Topic	Reading Assignment	Q/E/MP
1	8/25	this is advanced organic chemistry	**1.**Buskirk, Baradaran, "Can Reaction Mechanisms be Proven?", *JCE* **2009**, 551-8	
	8/27	enantiomerism	**2.** *C&S A* 5th 119-141	
	8/29	diastereomerism and resolution	**3.***C&S A* 5th 119-141; Whitesides, Lewis, "The Determination of Enantiomeric Purity… " *JACS* **1971**, *93*, 5914-5915, **4**.*C&S A* 5th 208-210	
2	9/1	diastereomerism and resolution	**5.**Gawley, "Do the Terms % ee" and % de"…" *JOC* **2006**, *71*, 2411-2416	
	9/3	dynamic stereochemistry	**6**.*C&S A* 5th 169-198; **7**.Masamune, "Organoborane Compounds in Organic…" *JACS* **1985**, *107*, 4549-4551; **1**.*C&S A* 5th 119-141	**Quiz 1**
	9/5	prochirality	as above	**MP1**
3	9/8	acyclic conformational analysis	**8**.*C&S A* 5th 142-51	
	9/10	conformational analysis of cyclic compounds	**9**.*C&S A* 5th 152-169; **10**. *C&S A* **4**th 149-151	**MP2**
	9/12	conformation and reactivity	**6**.*C&S A* 5th 169-198	
4	9/15	conformation and reactivity	as above	
	9/17	Baldwin's rules	**11**.*C&S A* **4**th 166-171, **12-14**.Baldwin, "Rules for Ring Closure" *JCSCC* **1976** 734-741 (3 articles)	**MP3**
	9/19	Baldwin's rules	as above	**Quiz 2**
5	9/22	kinetic isotope effects	**1**.*C&S A* 5th 332-335	
	9/23	**Exam 1**	-	**Exam 1**
	9/24	labwork		
	9/26	TBA	-	
6	9/29	acid/base catalysis, solvent effects	**2**.*C&S A* 5th 345-368	
	10/1	linear free energy relationships	**3**.*C&S A* 5th 335-344	**MP 4**
	10/3	linear free energy relationships	*as above*	

7	10/6	redox conventions	**4**.Kjonaas, "Number of Oxidations…" *JCE* **1986**, *63*, 311-314
	10/8	$NaBH_4$/$LiAlH_4$	**5**.*C&S B* 4th 262-273 **MP 5**
	10/10	stereochemistry of hydride reduction	**6**.*C&S B* 4th 273-280
8	10/13	reduction of other functionality	**7**.Grabowski, "A Practical Process for the Preparation…"*JOC* **1993**, *58*, 2880-2888; *C&S B* 4th 273-280, **8**.Stryker, "Selective Hydride-*Mediated…" JACS* **1988**, *110*, 291-293 **MP 6**
	10/15	other sources of hydride	*C&S B* 4th 273-280 **Quiz 3**
	10/17	Long Weekend 2014	
9	10/20	α deprotonation of carbonyls	**9**.*C&S B* 4th 1-10
	10/22	alkylation of enolates	**10**.*C&S B* 4th 11-31 **MP 7**
	10/24	more alkylation issues	**11**.Negishi, "Highly Regioselective Generation…" *TL* **1983**, *24*, 1341-1344; **12**.Holton, "Regiospecific Preparation of Thermodynamic…*TL* **1983**, *24*, 1345-1348; **13**.Nakamura, "Alkylation of Magnesium…" *JACS* **2005**, *127*, 14192-14193
10	10/27	radicals: initiation and structure	**1**.*C&S A* 5th 965-970; **2**.976-992
	10/28	**Exam 2**	- **Exam 2**
	10/29	TBA	-
	10/31	Bu_3SnH and SmI_2 reduction of RX	**3**.P,F,&S 1-15; **4**.*C&S B* 4th 288-290; **5**.Inanaga, "A Mild and Convenient…" *CL* **1987**, 1485-1486
11	11/3	addition of radicals to alkenes	**6**.*C&S B* 4th 651-657; **7**. Giese, "Synthesis of δ-Lactones…" *JOC*, **1986**, *51*, 3726-3729,
	11/5	addition of radicals to alkenes	**8**.*C&S B* 4th 657-674; **9**.Curran, Rakiewicz, "Tandem Radical Cyclization…" *JACS* **1985**, **MP 8** *107*, 1448-9; **10**.Curran, "A Samarium(II) Promoted…." *JACS* **1988**, *110*, 5064-5067; **11**.Parker, "Total Synthesis of Bisabosqual A" *JACS* **2012**, *135*, 582-585;, **12**. Procter, Pleuromutilin *Chem. Eur. J.* **2013**, *19*, 6718-6723; **13**.Bode, "SnAP Reagents…" *ACIED* **2013**, *52*, 1705-8.
	11/7	Huckel MO theory for polyenes	**1-3**.*C&S A* 5th 27-39l; 713-718; 725-735
12	11/10	intro to pericyclic reactions	**4**.*C&S A* 5th 833-6 **MP 9**
	11/11	**Exam 3**	**Exam 3**
	11/12	electrocyclic reactions	**5**.*C&S A* 5th 892-906
	11/14	electrocyclic reactions	as above
13	11/17	sigmatropic rearrangements	**6**.*C&S A* 5th 911-921 **MP 10**
	11/19	Diels-Alder reaction	**7**.*C&S A* 5th 834-848
	11/21	more DA	**8**.*C&S A* 5th 860-873

14	11/24	Diels-Alder reaction	**9**.Stork, "The Temporary Silicon Connection…" *JACS* **1992**, *114*, 7578-7579; **10**.Padwa , "Application of Furanyl Carbamate…" *JOC* **2001**, *66*, 3119-3128 **11**. Hudlicky, "Short Chemoenzymatic Total…" ACIED **2014**, *53*, 4355-4358
	11/26	Thanksgiving 2014	
	11/28	Thanksgiving 2014	-
15	12/1	natural product synthesis	*C&S B* 4th 821-848
	12/3	same	TBA
	12/5	same	TBA
12/8-12		finals week	

Literature code:

ACIED = *Angewandte Chemie International Edition*
***C&S A* 5th** = Carey and Sundberg, Part A, "Advanced Organic Chemistry", 5th edition, 2007 (also one reading from the 4th edition)
***C&S B 4th*=** Carey and Sundberg, Part B, "Advanced Organic Chemistry, 4th edition, 2001
***CL* =** *Chemistry Letters*
***CEJ* =** *Chemistry A European Journal*
JACS = *Journal of the American Chemical Society*
JCE = *Journal of Chemical Education*
***JCSCC* =** *Journal of the Chemical Society, Chemical Communications*
JOC = *Journal of Organic Chemistry*
***P,F&S* =** Procter, Flowers, Skydstrup, "Organic Synthesis using Samarium Diiodide", 2010
TL = *Tetrahedron Letters*