Chemistry 610: Organic Reactions

Fall 2018

Tuesday and Thursday 2:20–3:35 PM

Room 2121, Chemistry

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Course Description

This course is designed to introduce upper-level undergraduates and beginning graduate students to advanced topics in organic chemistry (prerequisite: CHEM 646 or approval of instructor). The course begins with a discussion of the factors governing bonding and reactivity. This section will be followed by generalities about reaction mechanisms and a lecture on conformational analysis in both cyclic and acyclic systems. A discussion on the important classes of organic transformations will then be presented. A presentation of recent advances in the field of organic chemistry, as well as an introduction to (retro)synthetic analysis of complex molecules, will conclude this class.

Learning Outcomes

1) Understand the basics of bonding and reactivity.
2) Apply these concepts to understand common reaction mechanisms.
3) Demonstrate mastery of course content by proposing viable routes for the synthesis of complex molecules.

Office Hours

Wednesday 8:30–10 AM, or by appointment, Chemistry 304

Texts

Course Texts

Clayden, Greeves, Warren, and Wothers, **Organic Chemistry**, 2nd Edition, Oxford University Press, ISBN: 978-0-199-27029-3 (on reserve at Evans Library).
Kürti and Czakó, **Strategic Applications of Named Reactions in Organic Synthesis**, Elsevier Academic Press, ISBN: 978-0-124-29785-2.

Supplemental Texts

Carey and Sundberg, **Advanced Organic Chemistry A and B**, Kluwer Academic / Plenum Publishers, ISBNs: 978-0-306-46856-8 (A) 978-0-306-47380-7 (B). Available as an e-book through TAMU library.
Smith and March, **March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure**, John Wiley & Sons, Incorporated, ISBN: 978-0470462591. Available as an e-book through TAMU library.
Kirby, **Stereoelectronic Effects**, Oxford University Press, ISBN: 019-8-55893-7. Available at the Reserve Desk at Evans Libray.

Additional Resources

Practice problems: evans.rc.fas.harvard.edu/problems/index.cgi
Synthesis notes:
Baran Lab: https://baranlab.org/research/seminars/
MacMillan Lab: chemlabs.princeton.edu/macmillan/presentations/
Myers Lab: https://faculty.chemistry.harvard.edu/myers/pages/chem-215-handouts

Molecular models may help with homework problems and can be used during all exams. A kit

is sold by ACS Student Affiliates outside of room 2104. Alternatively, the stereochemistry molecular model (4000A/Standard set) sold by HGS is a great tool.

Contacting Me

There are a few reliable ways to get the help you need.

• Office hours: Wednesday mornings, 8:30–10:00 AM, Chem 304
• Email: For all emails regarding class, include "Chem610" in the subject line. I will do my best to respond within 24 hours.
• For quick questions, before and after class are good times.

Course Grades

Problem sets	150 points (50 pts/exam)
Mini-review	100 points
Class participation	50 points
Two in-class examinations	200 points (100 pts/exam)
Synthesis bootcamp	100 points
Final examination	200 points
Total	*800 points*

Grades will be assigned as follows: A: ≥90%; B: 80–89%; C: 70–79%; D: 60–69%; F: <60% based on top score. *These grade cut-offs may be lowered, but they will not be raised.*

Problem sets will be distributed in class; collaboration on these homework assignments is encouraged, but each student must hand in their own problem set. Information regarding the mini-review project will be forthcoming. Your grade will be based on your cumulative performance towards the total number of points possible in the course. To ensure final grades reflect your best effort, if your final exam score (%) exceeds any of your in-class exam scores, your in-class exam score will be replaced by that of the final exam.

Attendance

Class participation counts toward your grade and therefore attendance is required. If you are going to miss a class with a University excused absence, documentation will be required. See http://student-rules.tamu.edu/rule07 to verify that your absence is excusable. If prior contact is impossible, the student must provide notification by the end of the second working day after the absence. Any misinformation included on the form or an inability to verify the information will lead to sanctions under the Aggie Code of Honor.

Americans with Disabilities Act (ADA) Policy Statement

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. If you believe you have a disability requiring an accommodation, please contact Disability Services, currently located in the Disability Services building at the Student Services at White Creek complex on west campus or call 979-845-1637. For additional information visit http://disability.tamu.edu/.

Aggie Honor Code Policy

"An Aggie does not lie, cheat of steal, or tolerate those who do." Upon accepting admission to Texas A&M University, a student immediately assumes a commitment to uphold the Honor Code, to accept responsibility for learning, and to follow the philosophy and rules of the Honor System. Students will be required to state their commitment on examinations, research papers, and other academic work. Ignorance of the rules does not exclude any member of the TAMU community from the requirements or the process of the Honor System. Additional information about the Aggie Honor Code can be found at: http://www.tamu.edu/aggiehonor/. The consequences for cheating and plagiarism on any assignment associated with CHEM610 will result in an unsatisfactory grade for the course.

Schedule of Lectures and Tentative Exam Dates

Listed below is a schedule of approximate lecture coverage and approximate exam dates.

Lecture	Date	Topics	Reading Assignment
1	Aug 28	Bonding and Reactivity: Steric, Electronic, Stereoelectronic Effects	Clayden: chapters 1, 2, 4; Kirby: chapter 2
2	Aug 30	Conformational Analysis	Clayden: chapter 16; Kirby: chapter 3
3	Sep 4	Kinetics vs Thermodynamics	Clayden: chapter 12
4	Sep 6	Reaction Mechanisms and Conformational Effects on Reactivity	
4	Sep 11	Reaction Mechanisms and Conformational Effects on Reactivity	
5	Sep13	Synthesis of Chiral Molecules	Clayden: chapter 14, 41
6	Sep 18	Oxidation Reactions Part I: Epoxidation Reactions	Clayden: chapter 19; C&S, B: chapter 12
7	Sep 20	Oxidation Reactions Part II: Dihydroxylation, Alcohol Oxidations	Clayden: chapter 19; C&S, B: chapter 12
7/8	Sep 25	Oxidation Reactions Part II/Reduction and Nucleophilic Reactions	Clayden: chapter 23; C&S, B: chapters 2.6, 5
8	Sep 27	Reduction and Nucleophilic Reactions **Problem set 1 due**	Clayden: chapter 23; C&S, B: chapters 2.6, 5
9	Oct 2	Reduction and Nucleophilic Reactions	
10	Oct 4	Hydrofunctionalization	C&S, B: chapter 4.5
	Oct 9	**Exam 1**	
11	Oct 11	Enolate Generation and Alkylation	Clayden: chapter 20
11/12	Oct 16	Enolate and Aldol Reaction	Clayden: chapter 26
12	Oct 18	Aldol, Enolate Equivalents	Clayden: chapter 26
13	Oct 23	Carbocation Chemistry and Cyclizations	C&S, B: chapter 10.1
14	Oct 25	Carbon Radical Chemistry and Cyclizations	Clayden: chapter 37
15	Oct 30	Intro to Pericyclic Reactions: Electrocyclizations	Clayden: chapter 35
16	Nov 1	Cycloadditions Part I – Diels-Alder **Problem set 2 due**	Clayden: chapter 34; C&S, B: chapter 6
17	Nov 6	Cycloadditions Part II – [2+2] Reactions, Dipolar Cycloadditions	Clayden: chapter 34; C&S, B: chapter 6
	Nov 8	**Exam 2**	

18	Nov 13	Sigmatropic Rearrangements - [1,3], [2,3], [3,3] (Cope, Claisen)	Clayden: chapter 35; C&S, B: chapter 6
19	Nov 15	Group Transfers: Ene Reactions/Olefin Synthesis	C&S, B: chapter 2.4
20	Nov 20	Migratory Insertion, Transmetalation, Introduction to Pd Catalysis **Problem set 3 due**	C&S, B: chapter 8
	Nov 22	**Thanksgiving**	
21	Nov 27	Recent Methods in Organic Chemistry	
22	Nov 29	Synthetic Analysis **Mini-review (part I) due**	Clayden: chapter 28; C&S, B: chapter 13
23	Dec 4	Synthesis Bootcamp	
24	Dec 6	Review Session **Mini-review (part II) due**	
	Dec 12	**Final Exam (1-3pm)**	