

CHEM 430/530: Physical Organic Chemistry

M/W/F 1:30 – 2:20 pm, BAG 260

COURSE OBJECTIVES:

This course is designed for first year graduate students or advanced undergraduates with a desire to use fundamental principles of organic chemistry to predict structure and reactivity. A broad overview of organic reactions with an emphasis on mechanism will be covered. This course assumes a firm understanding of organic chemistry at the sophomore level and builds on that foundation. By the end of this course, students should be able to propose reaction pathways using arrow-pushing mechanisms and be able to justify these pathways using fundamental physical organic principles such as frontier molecular orbital theory, resonance, sterics, electrostatics, and thermodynamics. CHEM 430/530 is a prerequisite for CHEM 431/531.

INSTRUCTOR:

Professor Matthew Golder (goldermr@uw.edu, CHB 204H)

Office hours: Tuesday 9:30 – 10:30 AM (CHB 204H) or by appointment

Teaching Assistant: Dr. Julia Nguyen (jhn1@uw.edu)

Office hours: Wednesday 11:00 AM – 12:00 PM (BAG 331)

COURSE WEBSITE AND COMMUNICATION:

Canvas: <https://canvas.uw.edu/courses/1318699>

Questions regarding content on problem sets and exams should be directed to the Canvas discussion board. Chances are high that if you have a question, someone else likely has a question as well. I will answer questions on Canvas for the whole class to see.

For all email correspondences, please include CHEM 430 or CHEM 530 in the subject line.

TEXTBOOKS:

E. V. Anslyn & D. A. Dougherty. *Modern Physical Organic Chemistry*. University Science Books: Sausalito, CA, 2006.

(Note: I have an extra copy in my office for *temporary* loans)

I. Fleming. *Molecular Orbitals and Organic Chemical Reactions*. John Wiley & Sons: New York, 2010.

(Note: This book is available online as a PDF from any UW-campus connection -- <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470689493>)

Also recommended for graduate students:

F. A. Carey and R. A. Sundberg. *Advanced Organic Chemistry. Part A. Structure and Mechanism, 5th Ed.* Kluwer Academic/Plenum Publishers, New York, 2007.

Additional articles and handouts will be assigned periodically for reading. Content from these materials may or may not show up on exams.

PROBLEM SETS:

Problem sets will be assigned throughout the course (approximately six in total). We will go over select problems as part of scheduled group problem solving sessions during class (see schedule below). Students will be responsible for drawing out answers on the board, which we will then all discuss together. Due dates/times will be listed on each problem set. Solutions will also be posted on Canvas.

EXAMS:

Midterm #1: Take Home --- Assigned Monday 10/14, due Wednesday 10/16

Midterm #2: Monday 11/18 (take home problems due Wednesday 11/20)

Final Exam: Monday 12/9, 2:30 – 4:20pm (BAG 260)

Midterm exams will consist of either take home problems (Midterm #1) or an in-class component and take home problems (Midterm #2). The take home component is due at the beginning of class on the indicated date. Graduate students in CHEM 530 will do all of the take home problems; undergraduates in CHEM 430 will select some of the assigned problems to complete. You are welcome to work in groups, but I ask that you only write down answers you are comfortable defending. The final exam is neither take home nor meant for group work, so if you simply write down answers you don't understand fully during the midterms, you won't be prepared to work on problems yourself during the final. You may use your notes and books for the take home problems, but please do not use Scifinder, Reaxys, Google Scholar, etc to look up the original references. Please communicate to me ahead of time if you have an issue with any of the exam dates (midterms or final exam date). Except for religious reasons (see below), all other unavoidable conflicts will need to be approved by Dr. Eric Camp (BAG 303D, ericcamp@uw.edu).

GRADING:

Final exam (35%), higher midterm (30%), lower midterm (20%), problem sets (15%). The final exam can replace your lower midterm score. Problem sets will be graded with a “check”, “check-plus”, or “check-minus”. If you do not hand in a problem set, then you'll receive a 0 on that assignment.

RELIGIOUS ACCOMODATIONS:

Washington state law requires that UW develop a policy for accommodation of student absences or significant hardship due to reasons of faith or conscience, or for organized religious activities. The UW's policy, including more information about how to request an accommodation, is available at Religious Accommodations Policy (<https://registrar.washington.edu/staffandfaculty/religious-accommodations-policy/>). Accommodations must be requested within the first two weeks of this course using the Religious Accommodations Request form:

<https://registrar.washington.edu/students/religious-accommodations-request/>.

GENERAL TOPICS TO BE COVERED:

1. Molecular Orbital Theory
2. Arrow Pushing
3. Energy Diagrams
4. Transition State Theory
5. Carbocations
6. Addition to C=O, C=C, C=N
7. Substitution Reactions
8. Migratory Rearrangements
9. Elimination Reactions
10. Anions/Organometallics
11. Nucleophilic Pi-Bonds and Sigma-Bonds
12. Other Stereoelectronic Effects
13. Pericyclic Reactions