Chemistry GA.1311
Advanced Organic Chemistry: Reactions of Organic Compounds
Spring 2017
Professor Keith Woerpel
Monday, Wednesday, 8:00-9:15 AM, 25 West 4th Room C9
Office Hours: by arrangement

Objective
To develop an understanding of fundamental factors underlying synthetically useful organic reactions and to learn common synthetic transformations. The discussion will focus on the most common reactions, including their asymmetric variants, their mechanisms, and how these reactions are applied in synthesis.

On average, ≥75% of any synthesis involves the same types of reactions. We will spend most of our time with those transformations that are common to the synthesis of many classes of organic compounds.

You will get out of this class what you put into it. I am here to guide you through the important material, but you need to read and practice to master the material.

Prerequisite
Because of the advanced nature of reactions used in synthesis, a graduate course in physical organic chemistry or its equivalent is required. You need to be a master of the fundamentals of organic chemistry. If you have not had specific advanced courses, permission of the instructor is required; remedial material will need to be learned on one's own.

Textbook
We will not be using a textbook, because most of the books I have examined either cover too much material or cover older, less relevant material. If you would like a reference book for use in the class and beyond (although not necessary), consider one of the following (older editions are mostly suitable, too):

(1) Carey, F. A.; Sundberg, R. J. *Advanced Organic Chemistry Part B: Reactions and Synthesis*, Fifth Edition, Springer: New York, 2007.
(2) Smith, M. B.; March, J. *March's Advanced Organic Chemistry: Reactions, Mechanisms, and Structure*, Sixth Edition, Wiley: New York, 2007.

I give literature citations throughout the semester. Identify the important ones and read them. You will not need to read every paper from which I take examples, but these papers can serve as important examples of other reactions that have been discussed in the class.

I would highly advise starting to look through the recent literature at syntheses (maybe analyze one synthesis a week on your own). Start slowly and try to identify and understand reactions that are familiar. Then as you learn more reactions, revisit those same papers.

Problem Sets
There will be problem sets. These assignments will be graded and they represent a significant portion of the course grade. Although discussions with classmates is permitted, communal problem solving is not. The solutions you turn in should be your own work, and it is obvious to me when it is not your own work. In my experience, if you do not work on the problem sets on your own, you will not do well on the examinations. Problem sets will include both mechanisms and synthesis.

Closed-Book Exams
Mid-term exams will be: Wednesday, March 8 and Monday, April 10
Cumulative final examination: Monday, May 8

Lecture Grade
Problem Sets: ~20%
Midterm and Final Examinations: ~27% each

Course Content
I. Functional Group Interconversion by Nucleophilic Substitution
   A. At Saturated Carbon Atoms
   B. At Unsaturated Carbon Atoms
II. Protecting Group Chemistry
III. Reductions
   A. Additions to Carbonyl Groups
   B. Other Reductions
IV. Oxidations
   A. Oxidations of Alcohols and Related Reactions
   B. Oxidations of Other Organic Functional Groups
V. Alkene and Alkyne Synthesis
   A. Stereoselective Alkene Synthesis
   B. Alkyne Synthesis
   C. Metal-mediated Alkene Synthesis
VI. Alkylation of Nucleophilic Carbon: Enolate Chemistry
VII. Strategic Reactions in Synthesis
   A. Pericyclic Reactions
   B. Radical Reactions
   C. Carbene Reactions
VIII. Examples of Syntheses