Chemistry 6941 Fall 2006

Advanced Organic Chemistry 1

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Websites: 
http://www.as.ysu.edu/~pnorris/public_html
http://www.monomerchem.com/display4.html
http://www.liv.ac.uk/Chemistry/Links/reactions.html
http://www.organic-chemistry.org/
http://www.chem.harvard.edu/groups/myers/chemistry215handouts.htm

Exams: 3 exams during term worth 100 points each, 1 final exam worth 200 points (500 total)

9/27 (100 pts) 10/25 (100 pts) 11/22 (100 pts) Finals week (200 pts)

Overall course goals
Chemistry 6941 is the first class of a two semester sequence designed to give MS-level students a more in-depth look at the fundamentals of organic chemistry and the reactions that have been developed for organic synthesis. The early part of the course will deal with physical organic chemistry, i.e. the basic ideas of structure that lead to reactivity. The second portion of the class will then be a detailed coverage of important organic reactions, including their application in the formation of complex molecules, and will include discussion of modern methods that are of particular interest in natural products chemistry and medicinal chemistry.

Approximate Class Schedule

Week 1  Physical organic chemistry – Bonding (localized, delocalized, non-covalent)
Week 2  Physical organic chemistry – stereochemistry, reactive intermediates, arrow pushing
Week 3  Physical organic chemistry – acids and bases, arrow pushing, mechanisms
Week 4  Physical organic chemistry – arrow pushing, mechanisms
Week 5  Physical organic chemistry – arrow pushing, mechanisms

Rest of term – Chapter sequence from Zweifel and Nantz (see below)
Chapter 1 Synthetic Design

1.1 Retrosynthetic Analysis
1.2 Reversal of the Carbonyl Group Polarity (Umpolung)
1.3 Steps in Planning a Synthesis
1.4 Choice of Synthetic Method
1.5 Domino Reactions (aka Cascade or Tandem Reaction)
1.6 Computer-assisted Retrosynthetic Analysis

Chapter 2 Stereochemical Considerations in Planning Syntheses

2.1 Conformational Analysis
2.2 Evaluation of Nonbonded Interactions
2.3 Six-member Heterocyclic Systems
2.4 Polycyclic Ring Systems
2.5 Cyclohexyl Systems With sp²-Hybridized Atoms
2.6 Significant Energy Difference
2.7 Computer-assisted Molecular Modeling
2.8 Reactivity and Product Determination as a Function of Conformation

Chapter 3 The Concept of Protecting Functional Groups

3.1 Protection of NH Groups
3.2 Protection of OH Groups of Alcohols
3.3 Protection of Diols as Acetals
3.4 Protection of Carbonyl Groups in Aldehydes and Ketones
3.5 Protection of the Carboxyl Group
3.6 Protection of Double Bonds
3.7 Protection of Triple Bonds

Chapter 4 Functional Group Transformations: Oxidation and Reduction

4.1 Oxidation of Alcohols to Aldehydes and Ketones
4.2 Reagents and Procedures for Alcohol Oxidation
4.3 Chemoselective Reagents for Oxidizing Alcohols
4.4 Oxidation of Acyloins
4.5 Oxidation of Tertiary Allylic Alcohols
4.6 Oxidative Procedures to Carboxylic Acids
4.7 Allylic Oxidation of Alkenes
4.8 Terminology for Reduction of Carbonyl Compounds
4.9 Nucleophilic Reducing Agents
4.10 Electrophilic Reducing Agents
4.11 Regio- and Chemoselective Reductions
4.12 Diastereoselective Reductions of Cyclic Ketones
4.13 Inversion of Secondary Alcohol Stereochemistry (Mitsunobu)
4.14 Diastereofacial Selectivity in Acyclic Systems
4.15 Enantioselective Reductions
Chapter 5 Functional Group Transformations: The Chemistry of Carbon-Carbon π-Bonds and Related Reactions

5.1 Reactions of Carbon-Carbon Double Bonds
5.2 Reactions of Carbon-Carbon Triple Bonds

Chapter 6 Formation of Carbon-Carbon Single Bonds via Enolate Anions

6.1 1,3-Dicarbonyl and Related Compounds
6.2 Direct Alkylation of Simple Enolates
6.3 Cyclization Reactions – Baldwin’s Rules for Ring Closure
6.4 Stereochemistry of Cyclic Ketone Alkylation
6.5 Imine and Hydrzone Anions
6.6 Enamines
6.7 The Aldol Reaction
6.8 Condensation Reactions of Enols and Enolates
6.9 Robinson Annulation

Chapter 7 Formation of Carbon-Carbon Bonds via Organometallic Reagents

7.1 Organolithium Reagents
7.2 Organomagnesium Reagents
7.3 Organotitanium Reagents
7.4 Organocerium Reagents
7.5 Organocopper Reagents
7.6 Organochromium Reagents
7.7 Organozinc Reagents
7.8 Organoboron Reagents
7.9 Organosilicon Reagents
7.10 Palladium-catalyzed Coupling Reactions

Chapter 8 Formation of Carbon-Carbon π-Bonds

8.1 Formation of Carbon-Carbon Double Bonds
8.2 Formation of Carbon-Carbon Triple Bonds

Chapter 9 Syntheses of Carbocyclic Systems

9.1 Intramolecular Free Radical Cyclizations
9.2 Cation-p Cyclizations
9.3 Pericyclic Reactions
9.4 Ring-closing Olefin Metathesis (RCM)