CHEM 543 - ORGANIC REACTION MECHANISMS

Course Syllabus - 2003

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Course Goals: Modern organic chemistry depends on the ability to understand how and why molecules react, *i.e.,* reaction mechanisms. There are three goals for this course: 1) to present approximately 50 established organic reaction mechanisms, 2) to present means of determining mechanisms for newly discovered reactions, and 3) to present general mechanistic concepts: you will learn “electron pushing” and the rudiments of applying molecular orbital theory to reactions. This course will provide an essential foundation for understanding both organic synthesis and modern physical-organic chemistry.

Required Text: "Advanced Organic Chemistry"; M. B. Smith & J. March; 5th edition

Grading: a total of 240 pts divided as follows:

1) assigned problems: - 40 pts
2) midterm - 100 pts
3) final - 100 pts

Course Contents

1. Introduction - Basic concepts, ester hydrolysis.
2. Acids and bases, introduction to electronic effects.
3. Common substitution reactions at tetrahedral (SP^3) Carbon - S_N2, S_N1.
4. Basic orbital theory: antibonding orbitals and attack trajectories at SP^3 centers.
5. Nucleophilicity: hard-soft acid-base theory.
6. Typical carbocation processes.
7. Neighboring group effects.
8. Less common substitution mechnisms - radical anion, S_N2', etc.
9. β-Eliminations - E2, E1cb, E1, stereospecific, fragmentations.
10. Carbonyl addition mechanisms - polar, SET, Favorskii and benzil - benzilic acid rearrangements, attack trajectories.
11. Ylides - Stevens and Sommelet rearrangements.
12. Structure-activity relationships, more on electronic effects.
13. Free radicals - back-bite processes, Barton reaction, radical cyclizations.
14. Orbital Theory and its application to mechanisms.
15. Diels-Alder, Dipolar, and [2 + 2]-cycloaddition reactions.
16. Claisen and Cope rearrangements.
17. (time permitting) Carbenes and nitrenes - basic chemistry, metallocarbenes, carbene and carbenoid rearrangements.