University of Arkansas - Fort Smith
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General Syllabus

CHEM 4703 Organic Reaction Mechanisms

Credit Hours: 3 Lecture Hours: 3 Laboratory Hours: 0

Prerequisites: CHEM 2713 Organic Chemistry II and CHEM 4504 Physical Chemistry I

Effective: 2018~2019

I. Course Information

A. Catalog Description

Explores classical and modern methods of determining organic reaction mechanisms, examination of factors affecting the course of organic reactions and approaches (curved arrow, molecular orbitals) to interpreting organic phenomena. Surveys carbon-based intermediates and select "Name Reactions". Transition state theory, free energy relationships and select derivatives: the reactivity selectivity principle and the Brown Selectivity Relationship (BSR). Includes the survey of (hyper) deamination.

II. Student Learning Outcomes

A. Subject Matter

Upon successful completion of this course, the student will be able to:

1. Analyze the behavior of organic compounds and the fates of organic reactions in terms of electronic, steric and orbital interactions.
2. Evaluate reaction pathways of the main classes of organic compounds.
3. Evaluate, apply and draw reasonable curved arrow mechanisms for reactions.
4. Evaluate and utilize the molecular orbital approach to account for organic phenomena.
5. Apply experiments to elucidate reaction mechanisms.
6. Evaluate and critique chemical literature.
7. Apply and utilize effective technical oral presentation.

B. University Learning Outcomes

Organic Reaction Mechanisms enhances student abilities in the following areas:

Analytical Skills
Critical Thinking Skills: Students will identify a problem or issue and will research, evaluate, and compare information from varying sources in order to evaluate authority, accuracy, recency, and bias relevant to the problems/issues. Students will generate solutions/analysis of problems/issues evaluated and will assess and justify the solutions and/or analysis.

Communication Skills (written and oral)
Students will communicate proficiently. Students will compose coherent documents appropriate to the intended audience and effectively communicate orally in a public setting.

Ethical Decision Making
Students will model ethical decision-making processes. Students will identify ethical dilemmas and affected parties and will apply ethical frameworks to resolve a variety of ethical dilemmas.

Global & Cultural Perspectives
Students will reflect upon cultural differences and their implications for interacting with people from cultures other than their own. Students will demonstrate understanding or application of their discipline in a global environment and will demonstrate how their discipline impacts or is impacted by different cultures.

III. Major Course Topics

A. A review of fundamental organic concepts: Lewis structures, electronic effects (induction resonance, hyperconjugation, field effects, and acceptor agnostic-type interactions), steric effects (hindrance, acceleration, inhibition of resonance, persistent), acid/base, nucleophilicity/electrophilicity, the Pearson scale, redo
B. Electronic Interpretation of Organic Chemistry
C. Use of curved arrows
D. Molecular orbital approach (excluding pericyclic reactions)
E. Methods of Investigating Organic Reactions: product analysis, kinetics, stereochemistry, the use of isotopes, the study of intermediates, crossover experiments
F. Relative rates of organic reactions: proton transfer, ionic reactions, reactions at carbon centers at the various oxidation levels
G. Study of carbon-based intermediates: carbocations, carbanions, free radicals, carbenes, carbynes, arynes
H. Survey of name reactions: S_N (including S_N1 without racemization and kinetic analyses), Friedel-Crafts (including Brown Selectivity Relationship and Superelectrophilic Aromatic Substitution), Cannizarro, Benzil-Benzilic acid rearrangement, Hofman, Curtius, Schmidt, Lossen, Beckman rearrangements, Favorski reaction, von-Braun reactions, Ritter reaction and *N*-nitrososamide-mediate Ritter-type reaction. Ambident ion reactions
I. Transition State Theory
J. Linear Free Energy Relationships: Hammett and Taft equations

K. Pericyclic Reactions: electrocyclic reactions, cycloadditions, sigmatropic reactions
L. A brief look at deamination and hyperdeamination
M. A brief look at photochemistry