

CHEM3230 Conjugated Molecules and Synthetic Polymers

Course Description:

This course covers chemistry of conjugated molecules including aromatic hydrocarbons, aromatic heterocycles and pericyclic reactions, and provides a brief introduction to synthetic polymers. Fundamental concepts and important reaction mechanisms of conjugated molecules and synthetic polymers, such as aromaticity, electrophilic aromatic substitution reaction, the conservation of orbital symmetry theory and chain-growth polymerization, will be emphasized. This course will train students with respect to the following capabilities and visions: understanding the complexities of matters at molecular level; presenting molecular structures of organic compounds correctly and clearly; understanding mechanisms of important organic reactions; defining and analyzing practical problems of environment, health and sustainable development based on chemical structures and reactions; divergent and convergent thinking in planning organic synthesis; fundamental ideas in designing and producing materials and medicines at molecular level.

Prerequisite:

CHEM3220

Main Course Outline (for reference only):

1. Aromaticity and Arenes

- 1) Aromaticity
- 2) Understanding substituent effects in a quantitative way: the Hammett equation
- 3) Reactions of substituted benzenes
- 4) Polycyclic aromatic hydrocarbons (PAHs)

2. Aromatic Heterocycles

- 1) Nomenclature of heterocycles
- 2) Five-membered aromatic heterocycles
- 3) Six-membered aromatic heterocycles and pyridinium in coenzymes
- 4) Fused heteroaromatic compounds
- 5) Heterocyclic Macrocycles: Porphyrin, chlorophyll and vitamin B₁₂

3. Molecular Orbitals and Pericyclic Reactions

- 1) Molecular orbitals and prediction of pericyclic reactions
- 2) Electrocyclic reactions
- 3) Cycloaddition reactions
- 4) Sigmatropic rearrangements
- 5) Pericyclic Reactions in Biological Systems

4. Synthetic Polymers

- 1) Basic concepts of polymer structures and physical properties
- 2) Chain-growth polymers
- 3) Step-growth polymers