CHM 1321 B - 2017 Syllabus

Course Outline

Nomenclature: *Do it yourself*. You are responsible for naming chains up to 12 carbons long for all classes of compound covered (alkanes, alkenes, alkynes, alcohols, thiols, halides, amines, aldehydes, ketones, ethers, cyclic and acyclic molecules). You are NOT required to name bicyclic compounds. A guide to nomenclature will be available on the slides presented in class when appropriate. Pages 142-154 in the text cover the basics of nomenclature. You should use the index to find rules for selected functional groups. Also as a carry-on from the last semester, refresh your memory with the following:

a. "Organic" periodic table, electronegativity and periodic trends, covalent bonds
b. Drawing organic structures: Lewis & compressed structures, formal charge method, polarity, resonance

Part A: Introduction

1) Organic Molecular structure (Ch 1-2)
   c. Orbital shapes and hybridization. Bond angles and structure, σ and π bonds, geometries, relative energies
   d. Dipoles, Van der Waals forces, H-bonding. Molecular structure and bulk properties
   e. Atomic and molecular orbitals, molecular orbital theory, bonding and antibonding orbitals
2) Alkanes (Ch 4)
   a. Properties, line structures, σ bond rotation, conformations, energy potential diagrams, Newman projections
   b. Cycloalkanes, ring strain, conformations, configurations, syn/anti and cis/trans nomenclature.
   c. Chair conformation, axial and equatorial bonds, chair interconversions.
3) Stereochemistry (Ch 5)
   a. Stereochemistry, configuration and R/S nomenclature, enantiomers, diastereomers and meso compounds,
   b. Zig-zag structures, syn/anti nomenclature, resolution, optical activity, enantiomeric excess.

Part B: Simple Reactivity

1) Acids and bases (Ch 21)
   a. Acid/base reactions, acidity of organic compounds, inductive effects, resonance, periodic trends. Use of pKa values
   b. Functional groups, arrow notation, reaction co-ordinate diagrams.
2) π Bonds as electrophiles (20)
   a. Polarity of π bonds. Carbonyl compounds. Effects of resonance. Concept of mechanism, nucleophiles, electrophiles.

b. Reduction of carbonyl groups. Additions "across" π bonds. Sodium borohydride and lithium aluminum hydride.
c. Imines. Acid catalysis.
d. Cyanohydrin formation. Reversal of the reaction. Acid and base catalysis
e. Grignard reagents. Preparation. Polarity. Acid/base reactions. Carbonyl displacements.
f. Organo-lithiums. Acid/base reactions. Carbonyl displacements. Alkynyl and vinyl nucleophiles.
g. Hydrate formation. Equilibrium with carbonyl forms. Hemi-acetal formation. Intramolecular reactions and ring formation.
h. Acid and base catalysis in carbonyl additions. Oxonium ions. Additions to oxoniums.
i. Microscopic reversibility. Molecular orbitals and reactivity

Part C: π Bonds and Reactivity

1) π Bonds as nucleophiles (Ch 8-9-10)
   a. Markovnikov additions. Hydration. Oxy-mercuration. Regioselectivity
   b. Anti-Markovnikov additions. Hydroboration. Stereochemistry.
   c. Radical hydrohalogenation. Chain reactions and initiation.
   d. Epoxide formation. Concerted mechanisms. Stereochemistry.
   e. Halogenation. Stereochemistry. Halohydrin formation. Regiochemistry.
2) Aromatic compounds as nucleophiles (Ch 18-19)
   a. Aromaticity. Huckle rule. Antiaromatic compounds. Ions and heterocycles.
   b. Allyl groups and resonance. Allyl cation and anion.
   c. Electrophilic aromatic substitution. Directing groups. Electrophiles. Heterocycles.
   d. Manipulations of directing groups. Reductions. Hydrolysis.
   e. Multi-step synthesis. Retrosynthetic analysis. Disconnections.
   f. Allyl and Benzyl radicals. Benzylic ions and radicals. Control in radical reactions.