Chem 261 Assignment & Lecture Outline 4: Alkene Polymers, Conjugated Systems: Polyenes & Aromatics

Read

Organic Chemistry, W. Ogilvie et al. 1st Edition – 2018 – Nelson Ltd.

- Chapter 19 section 19.8
- Chapter 9 Conjugation and Aromaticity
- Chapter 10 Electrophilic Aromatic Substitution

Problems:

Do <u>Not</u> turn in, answers available in "Study Guide Student Solutions Manual " W. Ogilvie et al.

- Chapter 9: 9.2; 9.3; 9.5; 9.7; 9.8; 9.13; 9.14; 9.17
- Chapter 10: 10.1; 10.3b; 10.7; 10.9; 10.11a-c; 10.13; 10.19; 10.23

Lecture Outline # 4

I. Polymerization and Radical Reactions of Alkenes

- A. Radical Additions
 - 1. Hydrogen Halide Addition
 - 2. Addition of Alkyl Radicals
- B. Polymers and Polymerization
 - 1. Polyethylene and General Mechanism
 - 2. Other types of Polymers Nomenclature and Properties

II. Conjugated Systems and Resonance

- A. Nomenclature of Dienes and Allyl vs Vinyl
- B. Allyl Radical, Cation, and Anion Stabilization and Resonance
- C. Addition Reactions of Dienes
- D. Allylic Radicals and Allylic Cations Rubber and Polystyrene

III. Energy Characteristics of Allylic Systems

- A. Stability of Conjugated Dienes & Bond Lengths
 - 1. Conformations
- B. Visible and Ultraviolet Spectroscopy
 - 1. Measurement of spectra
 - 2. Absorption energies
 - 3. Biological significancePhysical Properties and Sources
- A. Physical Properties solubility, density, BP, MP
- B. Occurrence of Alkenes and Alkynes
- C. Terpenes and Isoprene Units

IV. Aromaticity, Benzene, and Nomenclature

- A. Structure and Properties of Benzene
 - 1. Resonance Stabilization
 - 2. Substitution vs. Addition Reactions
- B. Annulenes and Huckel's Rule
 - 1. Coplanar Systems of $(4n + 2) \pi$ Electrons
 - 2. Aromatic Ions Acidity of Parent Compounds
- C. Other Aromatic Systems Naphthalene, Anthracene, and Heteroaromatic Systems.
 - 1. Five membered rings Furan, Pyrrole, Thiophene, Imidazole
 - 2. Six membered rings Pyridine, Pyrimidine
- D. Nomenclature of Monosubstituted Benzenes
 - 1. As Derivatives of Benzene
 - 2. Common names (Phenol, Aniline, Anisole, etc.)
- E. Nomenclature of Multiply-Substituted Benzenes
 - 1. Using Numbers and Common Names
 - 2. Ortho, Meta, Para Nomenclature

V. Electrophilic Substitution Reactions

- A. Benzene General Mechanism
 - 1. Halogenation X₂
 - 2. Nitration HNO3
 - 3. Sulfonation SO3 .H2SO4
 - 4. Friedel-Crafts Alkylations Lewis Acid + RX
 - 5. Friedel-Crafts Acylations Acylium Ions from Acid Halides / Anhydrides
 - 6. Use of Clemmensen Reduction (Zn/Hg and HCl) with Friedel-Crafts Acylation
- B. Effects of Substituents
 - 1. Activation vs. Deactivation Electron Donating vs Electron Withdrawing Groups
 - 2. Orientation (Ortho-Para vs. Meta)
 - 3. Inductive vs. Resonance Effects
 - 4. Disubstituted Benzene Reactions

VI. Reactions of Side Chains and Substituents of Aromatic Systems

- A. Nitro to Amino to Diazonium Salts
 - 1. Reduction of Nitrobenzenes to Anilines and Diazotization (NaNO3 and HCl)
 - 2. Replacement of Diazo Group
 - 3. Azo Coupling and Dyes
- B. Oxidation of Alkyl Side Chains of Aromatic Compounds to Carboxylic Acids