Chem 161
Assignment & Lecture Outline 3:
Alkenes and Alkynes – Addition and Elimination Reactions

Read

From TWG Solomons and CB Fryhle "Organic Chemistry" 8th Edition (2004):

- Functional Group List pp 70-71 and Periodic Table (1 page back from Back Cover)
- Chapter 7 – Alkenes and Alkynes I: Properties and Synthesis
- Chapter 8 – Alkenes and Alkynes II: Addition Reactions
- Chapter 11 – Alcohols and Ethers: Sections 11.1 to 11.5, especially 11.4
- Chapter 10 – Radical Reactions: re-read especially Sections 10.9 and 10.10
- Special Topic A – Chain Growth Polymers

Problems

Do **Not** turn in, answers available in "Study Guide and Solutions Manual for Organic Chemistry" for Solomons. This is available in the Bookstore or can be borrowed from Cameron Library's Reserve Reading Room

- **Chapter 7:** 7.1 (E/Z only); 7.2; 7.3; 7.5 to 7.9; 7.13; 7.15; 7.16 to 7.19; 7.21; 7.22; 7.28; 7.32; 7.37; 7.38
- **Chapter 8:** 8.1; 8.2; 8.4; 8.5; 8.7 to 8.9; 8.11; 8.13; 8.16; 8.21; 8.23; 8.27; 8.28; 8.29; 8.34; 8.37; 8.38; 8.39; 8.42; 8.43
- **Chapter 10:** 10.2
- **Chapter 11:** 11.4
- **Special Topic A:** A1; A4

Lecture Outline #3

I. Structure and Nomenclature

A. Alkenes with one double bond
   1. Nomenclature
   2. Orbital Hybridization
   3. Stereoisomerism - cis, trans, and Z, E.
   4. Cycloalkenes

B. Polyenes

C. Alkynes
   1. Nomenclature
   2. Structure and Orbital Hybridization

II. Physical Properties and Sources

A. Physical Properties - solubility, density, BP, MP

B. Occurrence of Alkenes and Alkynes

C. Terpenes and Isoprene Units

III. Reactions of Multiple Bonds between Carbons

A. General Characteristics - Addition Reactions, electrophiles and nucleophiles
   1. Arrow Conventions for Mechanisms

B. Addition Reactions of Alkenes - Stereospecificity
   1. Hydrogenation
   2. Halogenation
   3. Halohydrin Formation
   4. Hydrogen Halide Addition – Markovnikov's Rule
   5. Water Addition - Alcohol synthesis
   6. Alcohol Addition - Ether synthesis
   7. Mercuration - Demercuration
   8. Hydroboration - Oxidation
   9. Hydroboration and Treatment with Acid

C. Oxidation of Alkenes
   1. Ozonolysis
   2. Osmium Tetroxide and Potassium Permanganate
   3. Epoxidation

D. Addition Reactions of Alkynes
   1. Hydrogenation
   2. Halogenation
   3. Hydrogen Halide Addition
   4. Hydration - aldehyde and ketone synthesis - tautomers
      a) Markovnikov Addition of Water
      b) Hydroboration - Oxidation

E. Oxidation of Alkynes
   1. Ozonolysis
   2. Potassium Permanganate

IV. Synthesis of Alkenes and Alkynes - Eliminations

A. Elimination Reactions
   1. El Mechanism - Saytzeff Rule, Leaving Groups
   2. E2 Mechanism - Stereochemistry

B. Synthesis of Alkenes and Alkynes
   1. Dehydrohalogenation
   2. Dehalogenation of <u>vic</u> - dihalides
   3. Dehydration of alcohols

C. Hydrogenation - Dehydrogenation

D. Replacement of Acetylenic Hydrogen
    1. Acidity of Alkynes
    2. Alkylation - Substitution Reactions
    3. Coupling of Acetylenes

V. 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