

**Chem 164/261**  
**Assignment & Lecture Outline 3:**  
**Alkenes and Alkynes – Addition and Elimination Reactions**

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**Read**

From TWG Solomons and CB Fryhle "Organic Chemistry" 10e Edition (2011)

- Functional Group List on pp 73-74 (pp 68-69 -9th Edition; pp 70-71 - 8th Edition) and (Periodic Table) one page back from Inside 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

**Problems**

Do **Not** turn in, answers available in "Study Guide and Solutions Manual for Organic Chemistry" for Solomons.

- **Chapter 7:** 7.1 (E/Z only); 7.2; 7.3 to 7.9; 7.13; 7.15; 7.17 to 7.22; 7.25 to 7.30 (ignore R/S for now); 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 to 8.22; 8.24; 8.26; 8.29; 8.35; 8.48, 8.51
- **Chapter 10:** 10.2
- **Chapter 11:** 11.3
- **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

1. General Characteristics - Addition Reactions, electrophiles & nucleophiles; 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. E1 Mechanism - Saytzeff Rule, Leaving Groups
  2. E2 Mechanism - Stereochemistry
- B. Synthesis of Alkenes and Alkynes
  1. Dehydrohalogenation
  2. Dehalogenation of vic - dihalides
  3. Dehydration of alcohols
- C. Hydrogenation - Dehydrogenation
- D. Replacement of Acetylenic Hydrogen
  1. Acidity of Alkynes
  2. Alkylation - Substitution Reactions

### 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