

**Chem 164/261**  
**Assignment & Lecture Outline 4:**  
**Alkenes and Alkynes – Addition and Elimination Reactions**

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**Read**

*Organic Chemistry*, Solomons, Fryle & Snyder 11e Edition

- Functional Group List – Learn to recognize – Please see Green Handout – also p 76 of text
- Periodic Table – Inside Front Cover - know 1<sup>st</sup> 10 elements (up through Neon)
- Relative Strength of Acids and Bases – Inside Front cover (reference only)
- Chapter 1 – Sections 1.13 & 1.14
- Chapter 7 – Alkenes & Alkynes: Structure, Properties & Synthesis
- Chapter 8 – Alkenes & Alkynes: Addition Reactions
- Chapter 10 – Radical Reactions (Alkenes) Sections 10.10 & 10.11

**Problems:**

Do Not turn in, answers available in "Study Guide Student Solutions Manual " Solomons, Fryle, Snyder

- **Chapter 1:** 1.22
- **Chapter 7:** 7.1 to 7.7; 7.10; 7.12; 7.13; 7.17; 7.20 to 7.22; 7.25 to 7.28
- **Chapter 8:** 8.1; 8.2; 8.4; 8.7; 8.8; 8.11; 8.13 to 8.15; 8.20 to 8.22; 8.24; 8.26; 8.28; 8.30
- **Chapter 10:** 10.15; 10.16

**Lecture Outline # 4**

**I. Structure and Nomenclature**

- A. Alkenes with one double bond
  - 1. Nomenclature
  - 2. Orbital Hybridization
  - 3. Stereoisomerism - cis, trans, and Z, E.
  - 4. Cycloalkenes
  - 5. Polyenes
- B. 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. Hydroboration - Oxidation
  8. 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
  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