

Problem Set 8

1. Read Chapter 7 Sections 1 & 2: You should be familiar with the structure and geometry at the C=C bond in alkenes, and how the sigma and pi bonds in a C=C bond are formed via orbital overlap end-to-end or side-to-side, respectively. Which bond is stronger in a C=C bond, the sigma bond or the pi bond? Why? How does the strength of a particular type of bond affect the reactivity of the electrons in that bond? You are responsible for knowing that the sigma bonds in alkenes determine the geometry of the molecule according to VSEPR, and that the pi bonds hold the two central carbon atoms and the four atoms bonded to them in a coplanar arrangement.
2. Read Chapter 7 Section 3: You should be familiar with the following terms: saturated, unsaturated, element or degree of unsaturation. You should know that a ring or a C=C bond introduces as one element/degree unsaturation, and that a C≡C bond introduces two elements/degrees of unsaturation.

Work the following problems found in Section 3 of Chapter 7: **Problems 1 and 2.**

3. Read Chapter 7 Section 4: You are responsible for knowing the IUPAC rules for naming alkenes and how to recognize and name common substituents that contain alkenes (i.e., methylene, vinyl, allyl, phenyl, and benzyl groups). Be familiar with the common names of simple alkenes (e.g., ethylene, propylene, etc.). You should be aware that the IUPAC rules for naming alkenes (and compounds with other organic functional groups) changed recently (1993) such that alkene can be named two different ways according to the Old and New IUPAC rules. It is preferable to name alkenes following the New IUPAC rules by placing the number indicating the position of the C=C bond within the parent name (e.g., but-2-ene) rather than preceding the parent name (e.g., 2-butene).

Work the following problem found in Section 3 of Chapter 7: **Problems 5.**

4. Read Chapter 7 Section 5: You should be familiar with *cis/trans* nomenclature for naming isomers of disubstituted alkenes, and (*E*)/(*Z*) nomenclature for naming di-, tri- and tetrasubstituted alkenes. Disubstituted alkenes can be named using either *cis/trans* or (*E*)/(*Z*) nomenclature. Study the Summary: Rules for Naming Alkenes.

Work the following problems found in Section 4 of Chapter 7: **Problems 6-8.**

5. Read Chapter 7 Section 6: This section gives a brief overview of the importance of alkenes as starting materials that can be converted into a wide variety of different functional groups. Chapter 8 covers the specific reactions of alkenes and the mechanisms by which alkenes are converted into different functional groups in depth.
6. Read Chapter 7 Section 7: You should be familiar with general trends in the properties of alkenes. Why do symmetrically substituted *cis*-alkenes have a small dipole moment, but the corresponding *trans*-alkenes do not?
7. Read Chapter 7 Section 8: You are responsible for understanding the stability of alkenes, how stability is measured via catalytic hydrogenation, and the effect that alkyl substituents and the positioning of alkyl substituents (e.g., *cis* vs. *trans*) have on the stability of alkenes and cycloalkenes. Why does introducing a C=C in three- and four-membered rings introduce additional ring strain beyond that observed in cyclopropane and cyclobutane? You should know Bredt's Rule and why C=C bonds generally do not form at bridgehead carbon atoms. Study

Solved Problem 7-2. Study Table 7-2 and Figure 7-8. The data in that table and figure serve as the basis for Zaitsev's Rule that alkenes with more highly substituted C=C bonds are usually more stable (lower in energy), and therefore favored in reactions that produce alkenes (i.e., elimination reactions).

Work the following problems found in Section 7 of Chapter 7: **Problems 12-14.**

Work the following problems found at the back of Chapter 7: **Problems 40-48, and 70.**