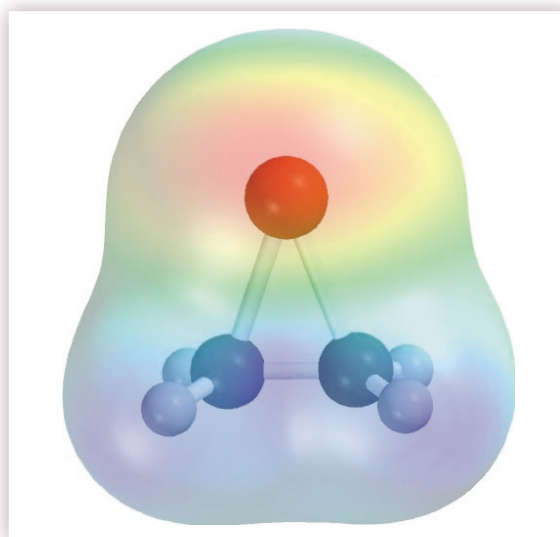


## CHAPTER OUTLINE

- 5.1 Hydrogenation of Alkenes
- 5.2 Electrophilic Addition of Hydrogen Halides to Alkenes
- 5.3 Regioselectivity of Hydrogen Halide Addition: Markovnikov's Rule
- 5.4 Mechanistic Basis for Markovnikov's Rule
- 5.5 Acid-Catalyzed Hydration of Alkenes
- 5.6 Addition of Halogens to Alkenes
- 5.7 Introduction to Organic Chemical Synthesis

Ethylene: One of the Most Important Industrial Organic Chemicals

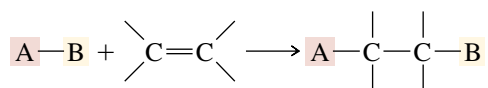
- 5.8 Electrophilic Addition Reactions of Conjugated Dienes
- 5.9 Acidity of Acetylene and Terminal Alkynes
- 5.10 Preparation of Alkynes by Alkylation
- 5.11 Addition Reactions of Alkynes
  - Hydrogenation
  - Metal–Ammonia Reduction
  - Addition of Hydrogen Halides
  - Hydration
- Learning Objectives
- 5.12 Summary
- Additional Problems



# CHAPTER 5

## ALKENES AND ALKYNES II: REACTIONS

Now that we know something of the structure and preparation of alkenes and alkynes, we will look at their chemical reactions. The characteristic reaction of alkenes and alkynes is **addition** to the double or triple bond. The general form of addition to an alkene may be represented as



The range of compounds represented as A—B in this equation is quite large, and their variety offers a wealth of opportunity for converting alkenes and alkynes to a number of other functional group types.

Alkenes and alkynes are commonly described as **unsaturated hydrocarbons** because they have the capacity to react with substances that add to them. Alkanes, on the other hand, are said to be **saturated** hydrocarbons and are incapable of undergoing addition reactions.

### 5.1 HYDROGENATION OF ALKENES

The relationship between reactants and products in addition reactions can be illustrated by the hydrogenation of alkenes to yield alkanes. **Hydrogenation** is the addition of H<sub>2</sub> to a multiple bond. An example is the reaction of hydrogen with ethylene to form ethane.