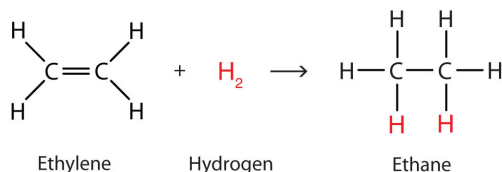


12.5: Chemical Properties of Alkenes

Learning Objectives

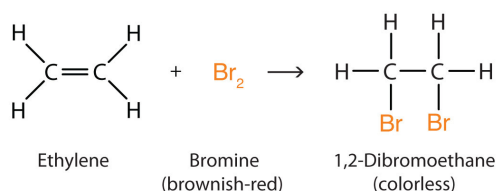
- To write equations for the addition reactions of alkenes with hydrogen, halogens, and water

Alkenes are valued mainly for addition reactions, in which one of the bonds in the double bond is broken. Each of the carbon atoms in the bond can then attach another atom or group while remaining joined to each other by a single bond. Perhaps the simplest addition reaction is hydrogenation—a reaction with hydrogen (H_2) in the presence of a catalyst such as nickel (Ni) or platinum (Pt).

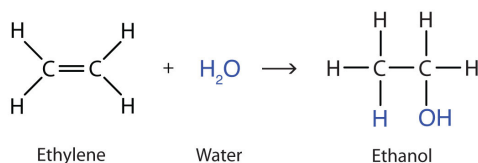


The product is an alkane having the same carbon skeleton as the alkene.

Alkenes also readily undergo halogenation—the addition of halogens. Indeed, the reaction with bromine (Br_2) can be used to test for alkenes. Bromine solutions are brownish red. When we add a Br_2 solution to an alkene, the color of the solution disappears because the alkene reacts with the bromine:



Another important addition reaction is that between an alkene and water to form an alcohol. This reaction, called hydration, requires a catalyst—usually a strong acid, such as sulfuric acid (H_2SO_4):



The hydration reaction is discussed later, where we deal with this reaction in the synthesis of alcohols.

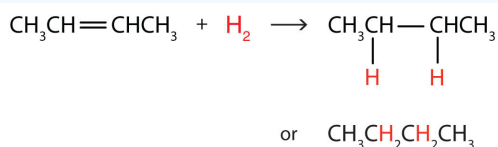
✓ Example 12.5.1

Write the equation for the reaction between $\text{CH}_3\text{CH}=\text{CHCH}_3$ and each substance.

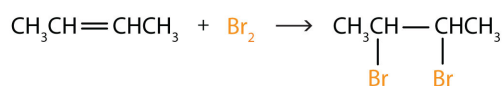
- H_2 (Ni catalyst)
- Br_2
- H_2O (H_2SO_4 catalyst)

Solution

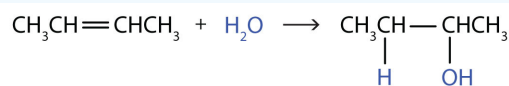
In each reaction, the reagent adds across the double bond.



a.



b.



c.



? Exercise 12.5.1

Write the equation for each reaction.

- $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$ with H_2 (Ni catalyst)
- $\text{CH}_3\text{CH}=\text{CH}_2$ with Cl_2
- $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_2\text{CH}_3$ with H_2O (H_2SO_4 catalyst)

Key Takeaway

- Alkenes undergo addition reactions, adding such substances as hydrogen, bromine, and water across the carbon-to-carbon double bond.

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