Organic Chemistry, *Fourth Edition*

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Chapter 15
Lecture Outline

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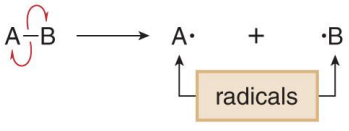
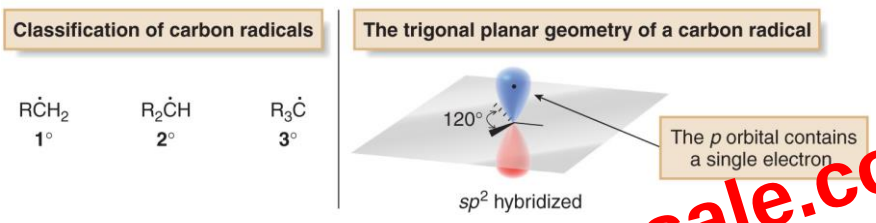
Radicals

- **A small but significant group of reactions involve radical intermediates.**
- **A radical is a reactive intermediate with a single unpaired electron, formed by homolysis of a covalent bond.**
- **A radical contains an atom that does not have an octet of electrons.**
- **Half-headed arrows are used to show the movement of electrons in radical processes.**



Structure of Radicals

- **Carbon radicals are classified as 1°, 2°, or 3°.**
- **A carbon radical is *sp*^{2} hybridized and trigonal planar, like carbocations.**
- **The unhybridized *p* orbital contains the unpaired electron and extends above and below the trigonal planar carbon.**



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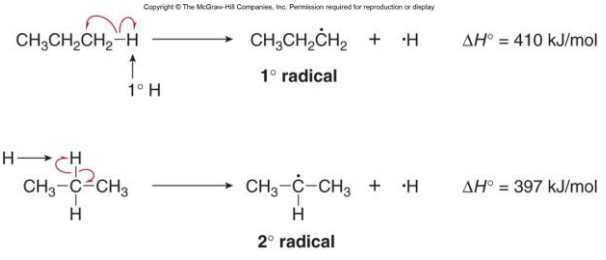
Bond Dissociation Energies

- **Bond dissociation energies for the cleavage of C—H bonds are used to measure stability.**
- **They are determined by calculating the energy needed to break the bond into two radicals.**
- **Cleaving a stronger bond requires more energy.**
- **In the example below, the 2º radical is more stable than the 1º radical because less energy is required to produce it.**



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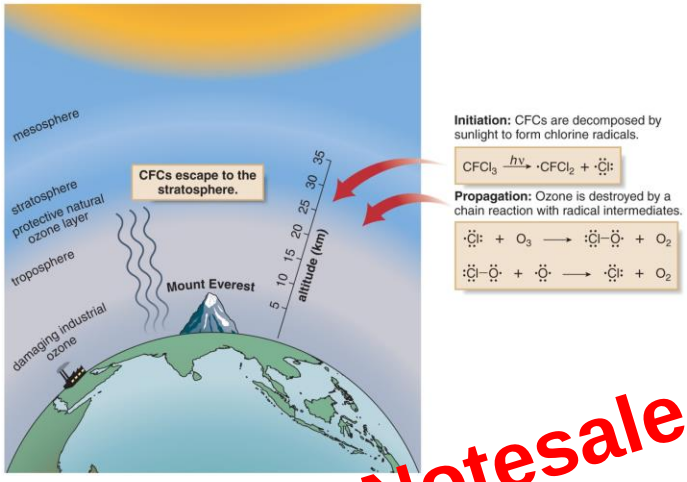
CFCs and the Destruction of the Ozone Layer

Figure 15.7



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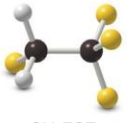
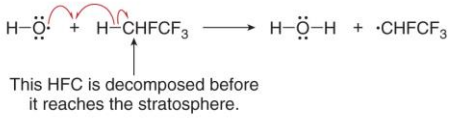
Alternatives to CFCs

- The overall result is that O_3 is consumed as a reactant and O_2 is formed.
- In this way, a small amount of CFC can destroy a large amount of O_3.
- New alternatives to CFCs are hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) such as CH_2FCF_3.
- These compounds are decomposed by HO• before they reach the stratosphere and therefore, they do not take part in the radical reactions resulting in O_3 destruction.





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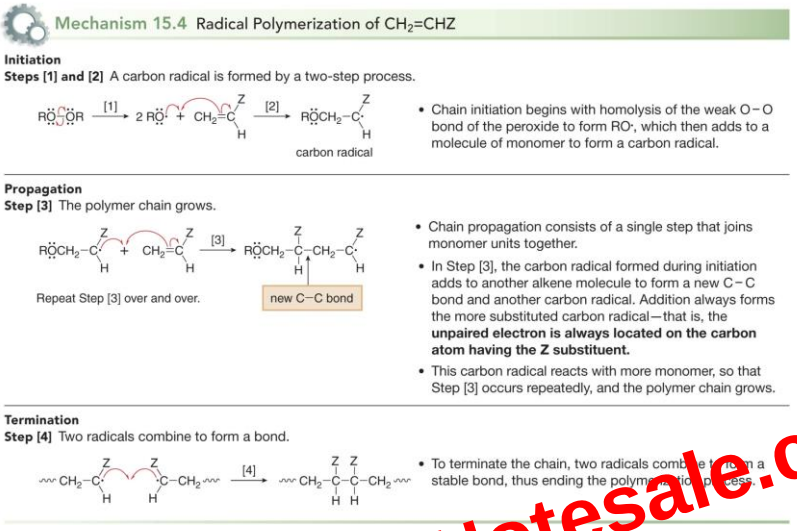

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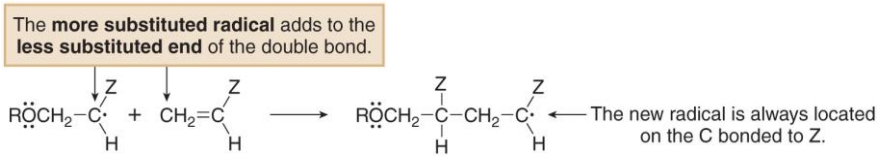
Radical Polymerization

- **In radical polymerization, the more substituted radical always adds to the less substituted end of the monomer, a process called head-to-tail polymerization.**



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