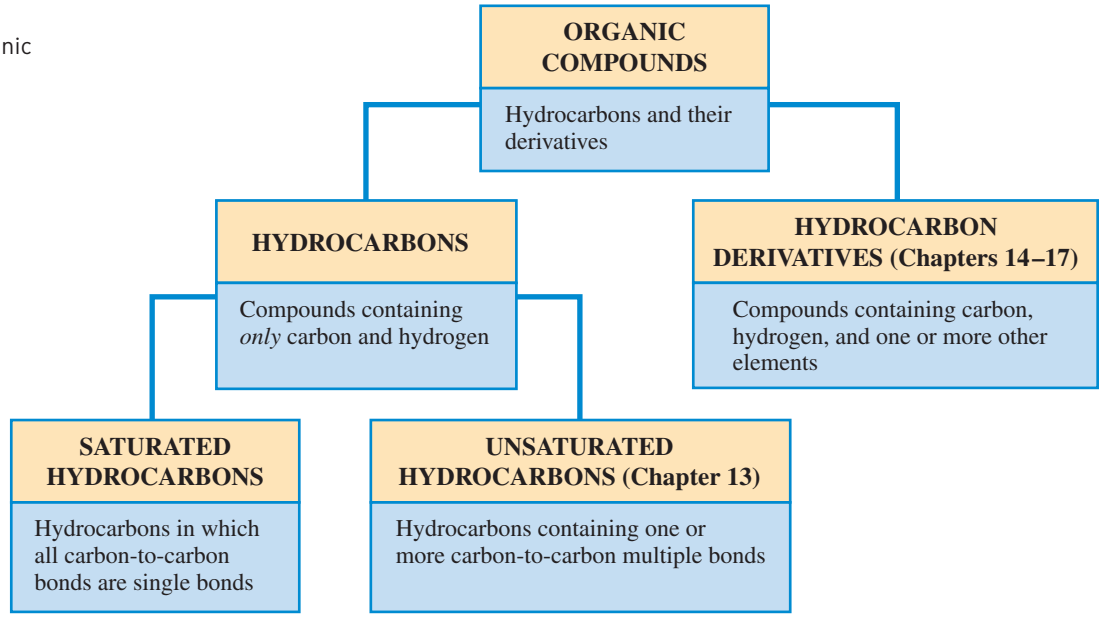


Figure 12.2 A summary of classification terms for organic compounds.

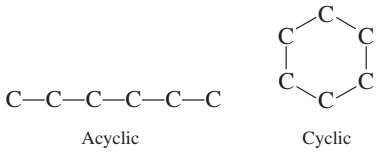
The term *saturated* has the general meaning that there is no more room for something. Its use with hydrocarbons comes from early studies in which chemists tried to add hydrogen atoms to various hydrocarbon molecules. Compounds to which no more hydrogen atoms could be added (because they already contained the maximum number) were called saturated, and those to which hydrogen could be added were called unsaturated.

elements. Additional elements commonly found in hydrocarbon derivatives include O, N, S, P, F, Cl, and Br. Millions of hydrocarbon derivatives are known.

Hydrocarbons may be divided into two large classes: saturated and unsaturated. A **saturated hydrocarbon** *is a hydrocarbon in which all carbon–carbon bonds are single bonds.* Saturated hydrocarbons are the simplest type of organic compound. An **unsaturated hydrocarbon** *is a hydrocarbon in which one or more carbon–carbon multiple bonds (double bonds, triple bonds, or both) are present.* In general, saturated and unsaturated hydrocarbons undergo distinctly different chemical reactions.

Saturated hydrocarbons are the subject of this chapter. Unsaturated hydrocarbons are considered in the next chapter. Figure 12.2 summarizes the terminology presented in this section.

Two categories of saturated hydrocarbons exist, those with *acyclic* carbon atom arrangements and those with *cyclic* carbon atom arrangements. The term *acyclic* means "not cyclic." The following notations contrast simple acyclic and cyclic arrangements of six-carbon atoms.



We first consider saturated hydrocarbons with *acyclic* carbon atom arrangements (Sections 12.4 through 12.11) and then saturated hydrocarbons with *cyclic* carbon atom arrangements (Sections 12.12 through 12.14).

12.4 ALKANES: ACYCLIC SATURATED HYDROCARBONS

An **alkane** *is a saturated hydrocarbon in which the carbon atom arrangement is acyclic.* Thus an alkane is a hydrocarbon that contains only carbon–carbon single bonds (saturated) and has no rings of carbon atoms (acyclic).

The molecular formulas of all alkanes fit the general formula C_nH_{2n+2}, where n is the number of carbon atoms present. The number of hydrogen atoms present in an alkane is always twice the number of carbon atoms plus two more, as in C_4H_{10}, C_5H_{12}, and C_8H_{18}.

The three simplest alkanes are methane (CH_4), ethane (C_2H_6), and propane (C_3H_8). Three different methods for showing the three-dimensional structures of these simplest of all alkanes