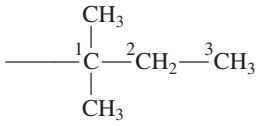
In IUPAC naming, hyphenated prefixes, such as *sec-* and *tert-*, are not considered when alphabetizing. The prefixes *iso* and *neo* are not hyphenated prefixes and are included when alphabetizing. The following IUPAC name is thus correct:

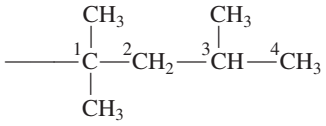
5-*sec*-Butyl-4-isopropyl-3-methyldecane

Complex Branched Alkyl Groups

Complex branched alkyl groups, for which no "simple" name is available (Figure 12.5), are occasionally encountered. The IUPAC system provision for such groups involves naming them as though they were themselves compounds. Select the *longest alkyl chain* in the complex substituent as the base alkyl group. The base alkyl group is then numbered beginning with the carbon atom attached to the main carbon chain. The substituents on the base alkyl group are listed with appropriate numbers, and parentheses are used to set off the name of the complex alkyl group. Two examples of such nomenclature follow.



(1,1-Dimethylpropyl) group



(1,1,3-Trimethylbutyl) group

12.12 CYCLOALKANES

It takes a minimum of three carbon atoms to form a cyclic arrangement of carbon atoms.

A **cycloalkane** *is a saturated hydrocarbon in which carbon atoms connected to one another in a cyclic (ring) arrangement are present.* The simplest cycloalkane is cyclopropane, which contains a cyclic arrangement of three carbon atoms. Figure 12.6 shows a three-dimensional model of cyclopropane's structure and those of the four-, five-, and six-carbon cycloalkanes.

Cyclopropane's three carbon atoms lie in a flat ring. In all other cycloalkane molecules, some puckering of the ring occurs; that is, the ring systems are nonplanar, as shown in Figure 12.6.

The general formula for cycloalkanes is C_nH_{2n}. Thus a given cycloalkane contains two fewer hydrogen atoms than an alkane with the same number of hydrogen atoms (C_nH_{2n+2}). Butane (C_4H_{10}) and cyclobutane (C_4H_8) are not isomers; isomers must have the same molecular formula (Section 12.6).

Line-angle structural formulas are generally used to represent cycloalkane structures. The line-angle structural formula for cyclopropane is a triangle, that for cyclobutane a square, that for cyclopentane a pentagon, and that for cyclohexane a hexagon.

Cyclopropane Cyclobutane Cyclopentane Cyclohexane

Note that, in such structures, the intersection of two lines represents a CH_2 group. Three- and four-way intersections of lines are possible when substituents are present on a ring. A three-way intersection represents a CH group and a four-way intersection is simply a carbon atom.