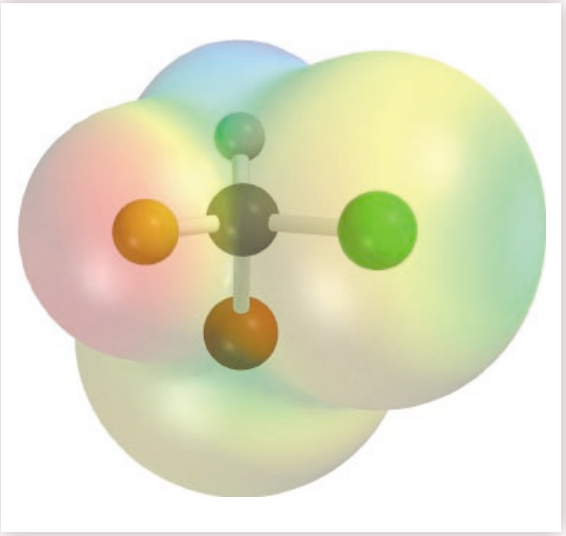

CHAPTER 7
STEREOCHEMISTRY

CHAPTER OUTLINE

We live in a three-dimensional world; in fact, a dictionary definition of three-dimensional is "life-like." Molecules are three-dimensional, as we saw in Chapter 1 when we discussed bonding and molecular shapes. The chemical changes that take place all around us, especially those in living organisms, are influenced by the three-dimensional relationships among molecules. The study of the spatial arrangement of atoms and molecules is known as **stereochemistry.** Isomers that have the same constitution but differ in the spatial arrangement of their atoms are called **stereoisomers.** We have already had considerable experience with certain types of stereoisomers—those involving cis and trans substitution patterns in alkenes and in cycloalkanes.

Our major objectives in this chapter are to develop a feeling for molecules as three-dimensional objects and to become familiar with stereochemical principles, terms, and notation. A full understanding of organic and biological chemistry requires an awareness of the spatial requirements for interactions between molecules; this chapter provides the basis for that understanding.

7.1 MOLECULAR CHIRALITY: ENANTIOMERS

Everything has a mirror image, but not all things are superimposable on their mirror images. Mirror-image superimposability characterizes many objects we use every day. Cups and saucers, forks and spoons, chairs and beds are all identical with their mirror images. Many other objects though—and this is the more interesting case—are not. Your left hand and your right hand, for example, are mirror images of each other but can't be made to coincide point for point in three dimensions. In 1894, William Thomson coined a word for this property. He defined an object as **chiral** if it is not superimposable on its mirror image. Applying Thomson's term to chemistry, we say that

William Thomson is better known as Lord Kelvin and is remembered for his contributions to the field of thermodynamics.