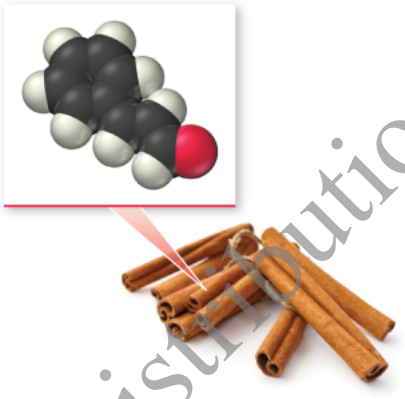
Pearson

4.12: Organic Compounds

In this chapter, we have examined chemical compounds. Early chemists divided compounds into two types: organic and inorganic. On the one hand, they designated organic compounds as those that originate from living things. Sugar—from sugarcane or the sugar beet—is a common example of an organic compound. Inorganic compounds, on the other hand, originate from the Earth. Salt—mined from the ground or from the ocean—is a common example of an inorganic compound.

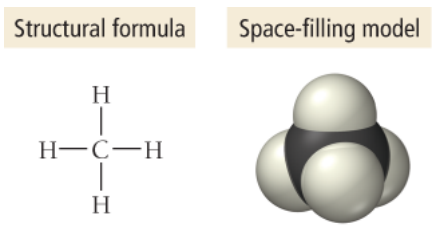
Eighteenth-century chemists could synthesize inorganic compounds in the laboratory but not organic compounds, so a clear difference existed between the two different types of compounds. Today, chemists can synthesize both organic and inorganic compounds, and even though organic chemistry is a subfield of chemistry, the differences between organic and inorganic compounds are now viewed as primarily organizational (not fundamental).



The organic compound cinnamaldehyde is largely responsible for the taste and smell of cinnamon.

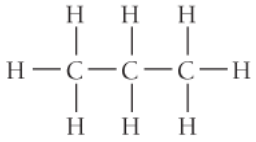
Organic compounds are common in everyday substances. Many smells—such as those in perfumes, spices, and foods—come from organic compounds. When we sprinkle cinnamon onto our French toast, some cinnamaldehyde—an organic compound present in cinnamon—evaporates into the air and we experience the unique smell of cinnamon. Organic compounds are the major components of living organisms. They are also the main components of most of our fuels, such as gasoline, oil, and natural gas, and they are the active ingredients in most pharmaceuticals, such as aspirin and ibuprofen.

Organic compounds are composed of carbon and hydrogen and a few other elements, including nitrogen, oxygen, and sulfur. The key element in organic chemistry, however, is carbon. In its compounds, carbon always forms four bonds. The simplest organic compound is methane or CH_4.

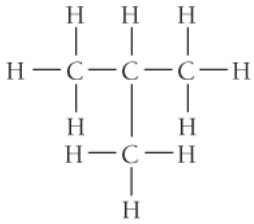


Methane, CH_4

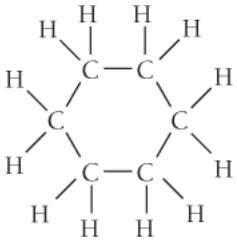
The chemistry of carbon is unique and complex because carbon frequently bonds to itself to form chain, branched, and ring structures such as the ones shown here:



Propane (C_3H_8)

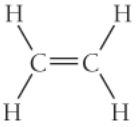


Isobutane (C_4H_{10})



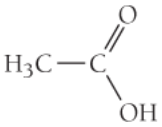
Cyclohexane (C_6H_{12})

Carbon can also form double bonds and triple bonds with itself and with other elements:



Ethene (C_2H_4)

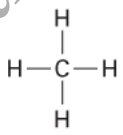
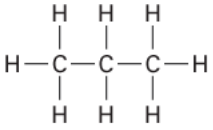
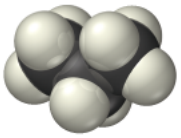
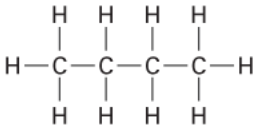
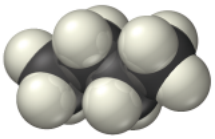
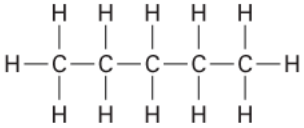
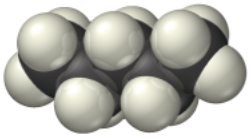
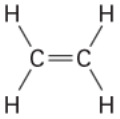
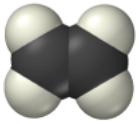
Ethyne (C_2H_2)



Acetic acid (CH_3COOH)

This versatility allows carbon to serve as the backbone of millions of different chemical compounds, which is why a general survey of organic chemistry is a year-long course. For now, all you need to know is that the simplest organic compounds are **hydrocarbons**, and they are composed of carbon and hydrogen. Hydrocarbons compose common fuels such as oil, gasoline, liquid petroleum gas, and natural gas. Table 4.5 lists some common hydrocarbons. You will recognize some of these compounds from your daily life. We often use organic compounds in examples throughout this book.

Table 4.5 Common Hydrocarbons

Name	Molecular Formula	Structural Formula	Space-filling Model	Common
Methane	CH_4			Primary cor of natural g
Propane	C_3H_8			LP gas for g outdoor sto
n-Butane*	C_4H_{10}			Common fu lighters
n-Pentane*	C_5H_{12}			Component
Ethene	C_2H_4			Ripening ag

Ethyne	C_2H_2	H—C≡C—H		Fuel for wel

*The "*n*" in the names of these hydrocarbons stands for "normal," which means straight chain.