

Chapter 6 Chemistry of Living Systems (Life Sciences)

Organic Compounds

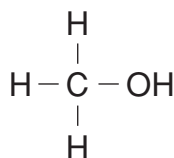
6. b. *Students know* that living organisms are made of molecules consisting largely of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.

An **organic compound** is a compound that contains carbon. Organic compounds are found in all living organisms. They are also found in the products made from living organisms.

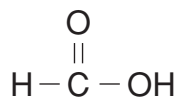
The simplest organic compounds are hydrocarbons. A **hydrocarbon** is an organic compound that contains only the elements carbon and hydrogen. Hydrocarbons are further classified according to the types of bonds between the carbon atoms. If a hydrocarbon has only single bonds, it has the maximum number of hydrogen atoms possible. These hydrocarbons are called **saturated hydrocarbons**. Ethane (C_2H_6) and propane (C_3H_8) are examples of saturated hydrocarbons.

Hydrocarbons with double or triple bonds are called **unsaturated hydrocarbons**. Unsaturated hydrocarbons have fewer hydrogen atoms for each carbon atom than a saturated hydrocarbon has. Ethene (C_2H_4) and ethyne (C_2H_2) are examples of unsaturated hydrocarbons.

In addition to hydrogen, carbon can form stable bonds with several other elements, including oxygen, nitrogen, and sulfur. A hydrocarbon that has atoms of other elements replace one or more of its hydrogen atoms is called a **substituted hydrocarbon**. Substituted hydrocarbons include alcohols and organic acids. An **alcohol** is a substituted hydrocarbon that contains one or more hydroxyl groups. A **hydroxyl group** ($-OH$) is made of an oxygen atom and a hydrogen atom. An **organic acid** is a substituted hydrocarbon that contains one or more carboxyl groups. A **carboxyl group** is written as $-COOH$.



Methanol



Formic acid

Figure 6-3 Substituted hydrocarbons

Methanol (an alcohol) and formic acid (an organic acid) are examples of substituted hydrocarbons.

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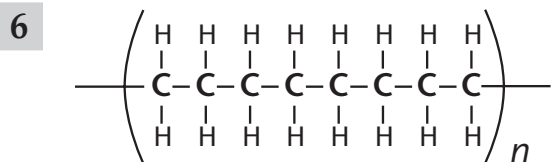
Other organic molecules have more complex structures than hydrocarbons or substituted hydrocarbons. A **polymer** is a very large molecule made of a chain of many smaller molecules bonded together. The smaller molecules are called **monomers**. In organic polymers, carbon, hydrogen, nitrogen, and in some cases oxygen atoms combine to form long, repetitive, stringlike molecules.

Most of Earth's biomass is made up of carbon and just five other elements: hydrogen, nitrogen, oxygen, phosphorus, and sulfur. Together, these six elements can combine in many different ways to form the large molecules that make up living organisms.

Standard 6. b. Check

- 5** Which chemical formula does *not* represent an organic compound?

A CH_3OH
B NH_3
C C_6H_{14}
D CHCl_3



In this organic molecule, CH_2 is repeated over and over. What kind of molecule is it?

A polymer
B organic acid
C alcohol
D diatomic molecule

- 7** Which organic compound contains one or more hydroxyl groups?

A unsaturated hydrocarbon
B saturated hydrocarbon
C alcohol
D organic acid

- 8** Which list of chemical symbols *best* identifies the elements that make up the molecules in living organisms?

A C, H
B C, H, N
C C, H, N, O, Po, Sr
D C, H, N, O, P, S