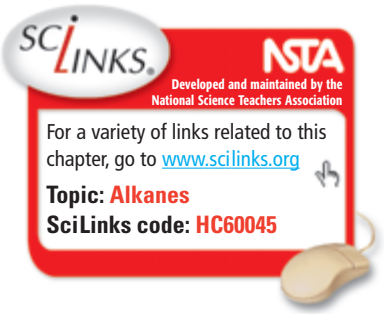
SECTION 2

Hydrocarbons

OBJECTIVES

- Distinguish among the structures of alkanes, alkenes, alkynes, and aromatic hydrocarbons.
- Write structural formulas and names for alkanes, alkenes, and alkynes.
- Relate properties of different types of hydrocarbons to their structures.

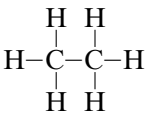


Hydrocarbons are compounds that contain only carbon and hydrogen. They make up the simplest class of organic compounds. All other organic compounds can be viewed as hydrocarbons in which one or more hydrogen atoms have been replaced by other atoms or groups of atoms.

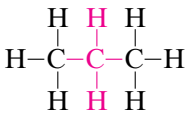
Hydrocarbons are grouped mainly by the type of bonding between carbon atoms. **Saturated hydrocarbons** *are hydrocarbons in which each carbon atom in the molecule forms four single covalent bonds with other atoms.*

Alkanes

Hydrocarbons that contain only single bonds are **alkanes.** In **Table 2,** the molecular formulas, structural formulas, and space-filling models are given for alkanes with one to four carbon atoms. If you examine the molecular formulas for successive alkanes in **Table 2,** you will see a clear pattern. Each member of the series differs from the preceding one by one carbon atom and two hydrogen atoms. For example, propane, C_3H_8, differs from ethane, C_2H_6, by one carbon atom and two hydrogen atoms, a $-CH_2-$ group.



ethane



propane

Compounds that differ in this fashion belong to a *homologous series.* A homologous series is one in which adjacent members differ by a constant unit. It is not necessary to remember the molecular formulas for all members of a homologous series. Instead, a general molecular formula can be used to determine the formulas. Look at the molecular formulas for ethane and propane, C_2H_6 and C_3H_8. They both fit the formula C_nH_{2n+2}. For ethane, $n = 2$, so there are two carbon atoms and $(2 \times 2) + 2 = 6$ hydrogen atoms. For propane, $n = 3$, so there are three carbon atoms and $(2 \times 3) + 2 = 8$ hydrogen atoms. Now consider a molecule for which we do not know the molecular formula. Suppose a member of this series has 30 carbon atoms in its molecules. Then $n = 30$, and there are $(2 \times 30) + 2 = 62$ hydrogen atoms. The formula is $C_{30}H_{62}$.