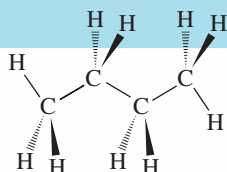


## Structural Representations for Alkane Molecules

## THREE-DIMENSIONAL STRUCTURAL REPRESENTATIONS

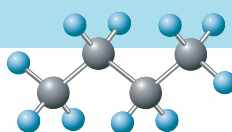
DASH-WEDGE-LINE  
STRUCTURE

Dashes represent bonds receding behind the page, wedges bonds coming out of the page, and solid lines bonds in the plane of the page.



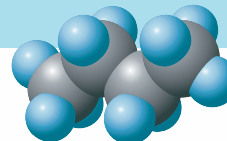
## BALL-AND-STICK MODEL

This type of model emphasizes the connections (bonds) among the atoms and shows the tetrahedral arrangement of bonds about carbon atoms.



## SPACE-FILLING MODEL

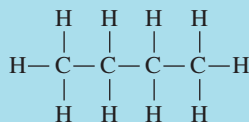
This type of model emphasizes the overall shape of the molecule and shows the tetrahedral arrangement of bonds about carbon atoms.



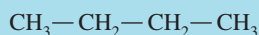
## TWO-DIMENSIONAL STRUCTURAL REPRESENTATIONS

EXPANDED  
STRUCTURAL  
FORMULA

A structural formula that shows all atoms in a molecule and all bonds connecting the atoms.

CONDENSED  
STRUCTURAL  
FORMULA

A structural formula that uses grouping of atoms, in which central atoms and the atoms connected to them are written as a group.

SKELETAL  
STRUCTURAL  
FORMULA

A structural formula that shows the arrangement and bonding of carbon atoms present but does not show the hydrogen atoms attached to the carbon atoms.

LINE-ANGLE  
STRUCTURAL  
FORMULA

A structural formula in which a line represents a carbon–carbon bond and a carbon atom is understood to be present at every point where lines meet and at the ends of lines.



## 12.10 CLASSIFICATION OF CARBON ATOMS

Each of the carbon atoms within a hydrocarbon structure can be classified as a primary, secondary, tertiary, or quaternary carbon atom. A **primary carbon atom** is a carbon atom in an organic molecule that is bonded to only one other carbon atom. Each of the “end” carbon atoms in the three-carbon propane structure is a primary carbon atom, whereas the middle carbon atom of propane is a secondary carbon atom. A **secondary carbon atom** is a carbon atom in an organic molecule that is bonded to two other carbon atoms.

