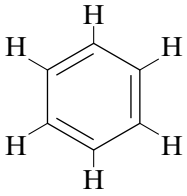
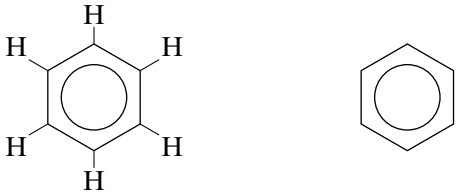
Aromatic Hydrocarbons

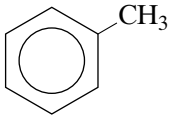
Aromatic hydrocarbons *are hydrocarbons that have six-membered carbon rings and delocalized electrons.* **Benzene** *is the primary aromatic hydrocarbon.* The molecular formula of benzene is C_6H_6. One possible structural formula is a six-carbon atom ring with three double bonds.



However, benzene does not behave chemically like an alkene. The entire molecule lies in the same plane, as shown in **Figure 11.** Benzene contains resonance hybrid bonds, and the structure of the benzene ring allows electrons to be spread through delocalized *p*-orbitals over the whole ring. The structural and skeletal formulas below show benzene as a resonance hybrid, representing the delocalization of electrons.



Aromatic hydrocarbons can be thought of as derivatives of benzene. The simplest have one benzene ring, as shown in the following example.



methylbenzene

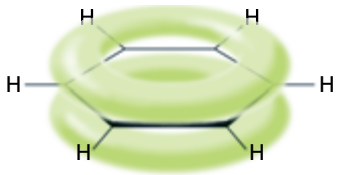


FIGURE 11 Electron orbitals in benzene overlap to form continuous *p*-orbitals that allow the delocalized electrons to spread uniformly over the entire ring.

SECTION REVIEW

1. List the basic structural features that characterize each of the following hydrocarbons:
   - **a.** alkanes
   - **b.** alkenes
   - **c.** alkynes
   - **d.** aromatic hydrocarbons
2. Draw all of the condensed structural formulas that can represent C_5H_{12}.
3. Give the systematic name for each compound in your answers to item 2.
4. Give examples of a property or use of three hydrocarbons.
5. Name the following compounds:
   - **a.** $CH_3-CH_2-CH(CH_3)-CH(CH_3)-CH_2-CH_3$
   - **b.** $CH_2=CH-CH=CH_2$
   - **c.** $CH_3-C\equiv C-CH_2-CH_3$

Critical Thinking

6. **ANALYZING INFORMATION** Write the structural formulas for an alkane, an alkene, and an alkyne that have five carbon atoms each. Why are these three hydrocarbons not considered isomers?