

**What you need to know about  
Organic Chemistry from CH1010**



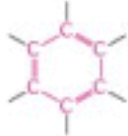
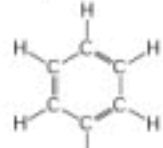

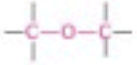

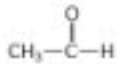

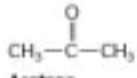
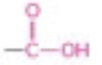
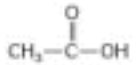
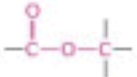
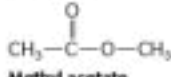
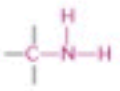
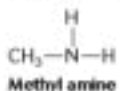
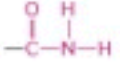
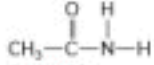
**Drawing organic Molecules  
Bonding - table 11.1**

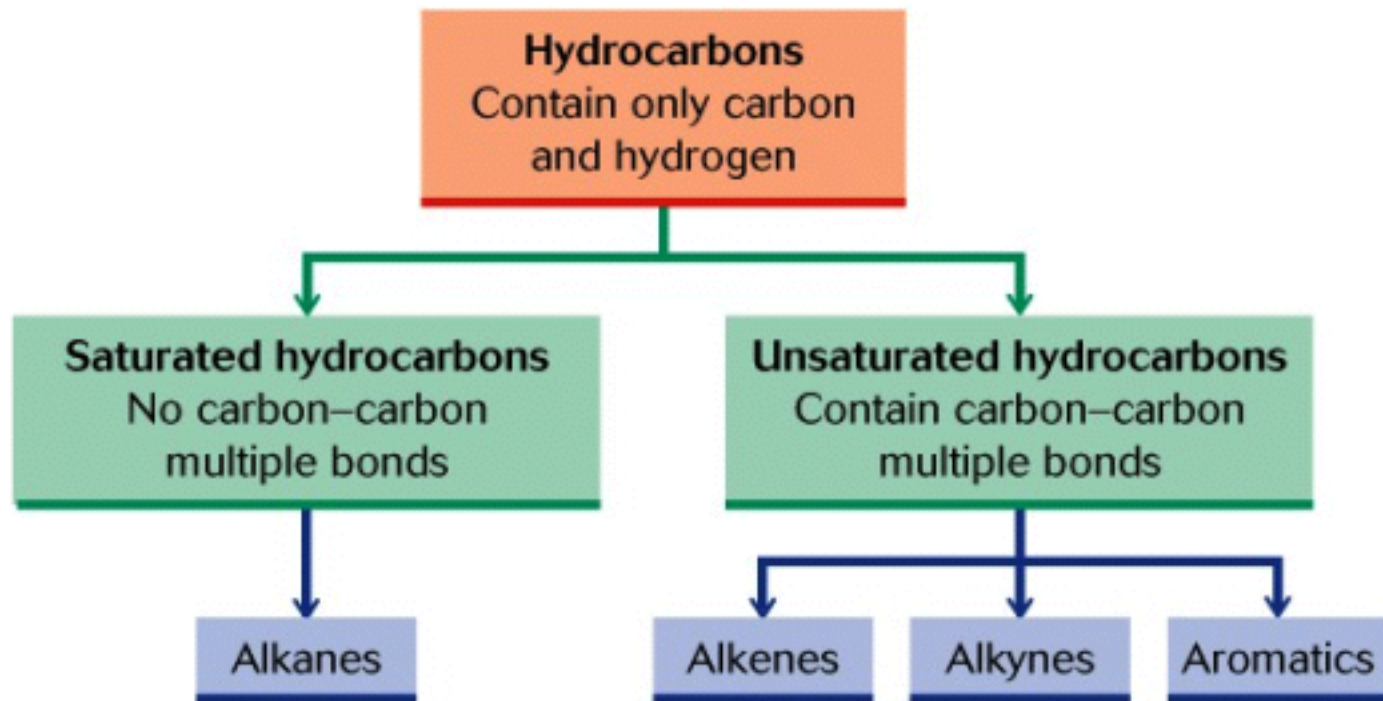
**Families of organic molecules  
Table 11.2**

**TABLE 11.1** Combining Powers of Elements Present in Organic Compounds

| Element         | Number of Bonds | Bonding Representation                         |
|-----------------|-----------------|--|
| C               | 4               | $\begin{array}{c}   \\ -C- \\   \end{array}$   |
| N               | 3               | $\begin{array}{c}   \\ -N- \\   \end{array}$   |
| O               | 2               | $-O-$  |
| H, F, Cl, Br, I | 1               | H— F— Cl— Br— I—                               |
| P               | 3               | $\begin{array}{c}   \\ -P- \\   \end{array}$   |
|                 | 5               | $\begin{array}{c}    \\ -P- \\   \end{array}$  |
| S               | 2               | $-S-$  |
|                 | 6               | $\begin{array}{c}    \\ -S- \\    \end{array}$ |

**TABLE 11.2** Families of Organic Compounds

| Family          | Functional Group  | Example  |
|-----------------|---|--|
| alkane          | C—C and C—H single bonds  | CH <sub>3</sub> —CH <sub>3</sub><br><b>Ethane</b>  |
| alkene          |    | CH <sub>2</sub> =CH <sub>2</sub><br><b>Ethylene</b>  |
| alkyne          |    | CH≡CH<br><b>Acetylene</b>  |
| aromatic        |    | <br><b>Benzene</b>         |
| alcohol         |    | CH <sub>3</sub> CH <sub>2</sub> —O—H<br><b>Ethyl alcohol</b>   |
| ether           |    | CH <sub>3</sub> —O—CH <sub>3</sub><br><b>Dimethyl ether</b>  |
| aldehyde        |    | <br><b>Acetaldehyde</b>    |
| ketone          |    | <br><b>Acetone</b>         |
| carboxylic acid |    | <br><b>Acetic acid</b>     |
| ester           |   | <br><b>Methyl acetate</b> |
| amine           |  | <br><b>Methyl amine</b>  |
| amide           |  | <br><b>Acetamide</b>     |



# Alkanes

Rules for nomenclature 11.6

Drawing structures and isomers  
11.4-11.6

Cycloalkanes 11.7

(cis and trans isomers 11.8)

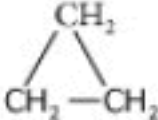

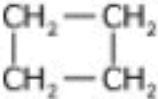

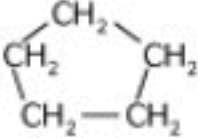

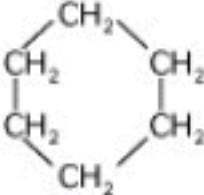

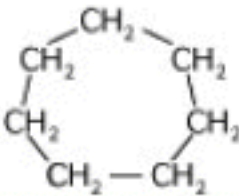

3 dimensional structure of  
cyclohexane



**TABLE 11.3** Formulas and Properties of Normal Alkanes

| <i>n</i> | Molecular Formula               | Condensed Structural Formula  | Name    | Melting Point (°C) | Boiling Point (°C) |
|----------|---------------------------------|---|---------|--------------------|--------------------|
| 1        | CH <sub>4</sub>                 | CH <sub>4</sub>   | methane | -182               | -162               |
| 2        | C <sub>2</sub> H <sub>6</sub>   | CH <sub>3</sub> CH <sub>3</sub>   | ethane  | -183               | -89                |
| 3        | C <sub>3</sub> H <sub>8</sub>   | CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>   | propane | -190               | -42                |
| 4        | C <sub>4</sub> H <sub>10</sub>  | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | butane  | -138               | -1                 |
| 5        | C <sub>5</sub> H <sub>12</sub>  | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | pentane | -130               | 36                 |
| 6        | C <sub>6</sub> H <sub>14</sub>  | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | hexane  | -95                | 69                 |
| 7        | C <sub>7</sub> H <sub>16</sub>  | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | heptane | -91                | 98                 |
| 8        | C <sub>8</sub> H <sub>18</sub>  | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>                                 | octane  | -57                | 126                |
| 9        | C <sub>9</sub> H <sub>20</sub>  | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>                 | nonane  | -51                | 151                |
| 10       | C <sub>10</sub> H <sub>22</sub> | CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub> | decane  | -30                | 174                |

**TABLE 11.5** Cycloalkanes

| Name         | Molecular Formula              | Structural Formulas  |   | Boiling Point (°C) |
|--------------|--------------------------------|--|---|--------------------|
|              |                                | Expanded <sup>a</sup>  | Condensed   |                    |
| cyclopropane | C <sub>3</sub> H <sub>6</sub>  |   |    | -33                |
| cyclobutane  | C <sub>4</sub> H <sub>8</sub>  |   |    | 12                 |
| cyclopentane | C <sub>5</sub> H <sub>10</sub> |   |    | 49                 |
| cyclohexane  | C <sub>6</sub> H <sub>12</sub> |   |    | 81                 |
| cycloheptane | C <sub>7</sub> H <sub>14</sub> |  |  | 119                |

<sup>a</sup>C-H bonds are not expanded.

# **Alkanes**

**Combustion of alkanes 11.10**

**Halogenation of alkanes 11.10**

**Nomenclature of  
Alkylhalides 11.10**





# Alkenes

Structure 12.1-12.3

Cis and trans isomers 12.5

Nomenclature of Alkenes 12.4

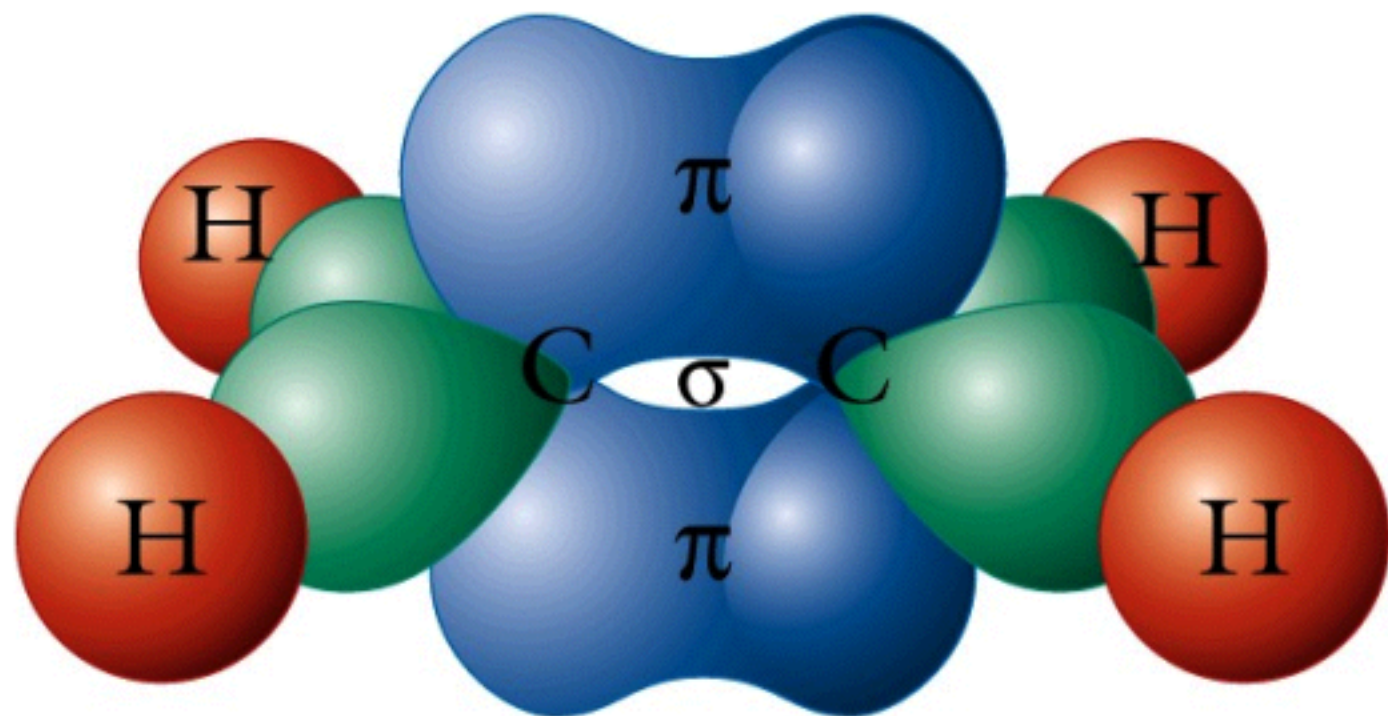


# Unsaturated Hydrocarbons

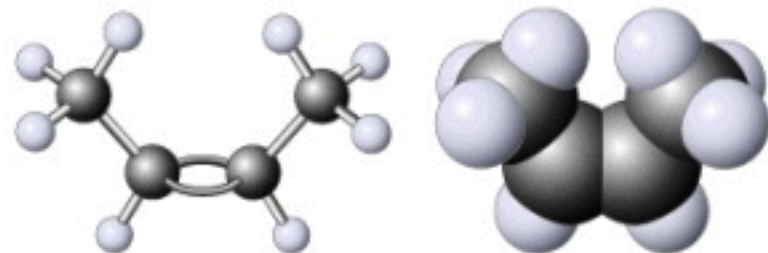
TABLE 12.1 Formulas and Properties of 1-Alkenes

| <i>n</i> | Molecular Formula               | Condensed Structural Formula   | Name      | Melting Point (°C) | Boiling Point (°C) |
|----------|---------------------------------|--|-----------|--------------------|--------------------|
| 2        | C <sub>2</sub> H <sub>4</sub>   | CH <sub>2</sub> =CH <sub>2</sub>   | ethene    | -169               | -104               |
| 3        | C <sub>3</sub> H <sub>6</sub>   | CH <sub>2</sub> =CHCH <sub>3</sub>   | propene   | -185               | -47                |
| 4        | C <sub>4</sub> H <sub>8</sub>   | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>3</sub>   | 1-butene  | -185               | -6                 |
| 5        | C <sub>5</sub> H <sub>10</sub>  | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | 1-pentene | -138               | 30                 |
| 6        | C <sub>6</sub> H <sub>12</sub>  | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | 1-hexene  | -140               | 63                 |
| 7        | C <sub>7</sub> H <sub>14</sub>  | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>   | 1-heptene | -119               | 94                 |
| 8        | C <sub>8</sub> H <sub>16</sub>  | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>                                 | 1-octene  | -102               | 121                |
| 9        | C <sub>9</sub> H <sub>18</sub>  | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub>                 | 1-nonene  | -81                | 146                |
| 10       | C <sub>10</sub> H <sub>20</sub> | CH <sub>2</sub> =CHCH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>2</sub> CH <sub>3</sub> | 1-decene  | -66                | 171                |

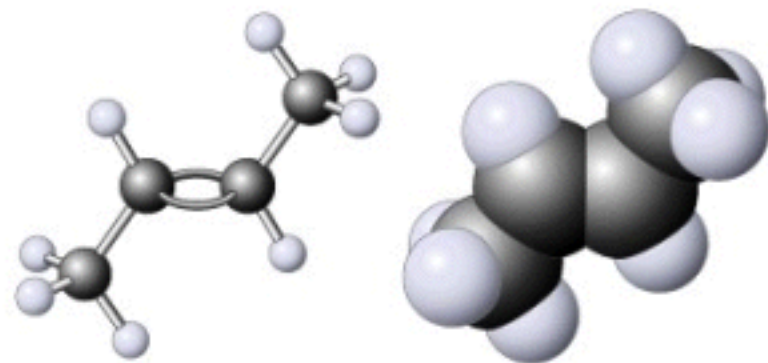
## The $\pi$ bond in alkenes



## INSIGHT INTO PROPERTIES



*cis*-2-Butene



*trans*-2-Butene



# Alkenes

Addition reactions of alkenes:

Hydrogenation

Halogenation

