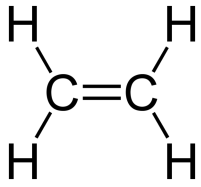
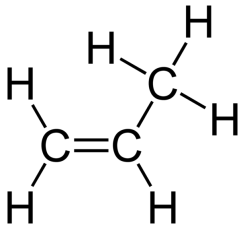
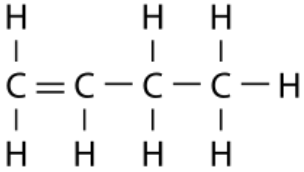
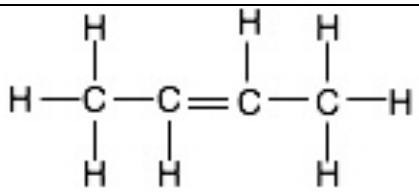
Alkenes

Unsaturated hydrocarbons that contain one or more double bonds between carbon atoms are called **alkenes**. Because alkenes must have a double bond between carbon atoms, there is no alkene with only one carbon.

Straight-chain Alkenes

When an alkene's carbon-carbon bonds can be connected with a single line, the alkene is called a **straight-chain alkene**. Some examples of straight chain alkenes are shown below:

Name	Molecular Formula	Structural Formula	Condensed Structural Formula
Ethene	C_2H_4		$CH_2 = CH_2$
Propene	C_3H_6		$CH_3 - CH = CH_2$
1-Butene	C_4H_8		$CH_2 = CH - CH_2 - CH_3$
2-Butene	C_4H_8		$CH_3 - CH = CH - CH_3$

Notice that in each alkene there are twice as many hydrogen atoms as there are carbon atoms. This leads us to the general formula for alkenes:

$$C_nH_{2n}$$

Also notice that alkenes with 4 or more carbons, such as butane, can have the double bond in different locations. Thus, they must be named differently in order to tell them apart.

Example 1
Determine the general formula for the alkene that has 6 carbon atoms.

Naming Straight-chain Alkenes

Alkenes are named in much the same way as alkanes. The name consists of two parts:

1. A root part that tells you how many carbon atoms the alkene has.

2. The suffix *–ene*.

To name alkenes with four or more carbons in the chain, we must also specify the location of the double bond. This is done by numbering the carbons in the chain starting at the end that will give the first carbon in the double bond the lowest number. Then, use this number in the name.

Example 2
Name each of the following alkenes:

a) $CH_2 = CH - CH_2 - CH_2 - CH_3$

b) $CH_3 - CH = CH - CH_2 - CH_3$

c) $CH_3 - CH_2 - CH = CH - CH_3$

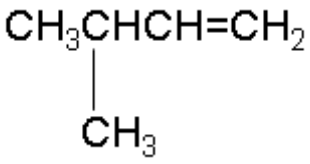
Naming Branched Alkenes

Alkenes with branched carbon chains are called **branched alkanes**. When naming branched alkenes, follow the same rules for naming branched alkanes—with two differences:

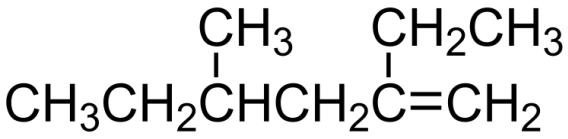
1. In alkenes, the parent chain is always the longest chain **that contains the double bond** (even if it isn't the longest chain of carbon atoms).

2. The position of the double bond, not the branches, determines how the chain is numbered.

Example 3
Name the alkene pictured below.

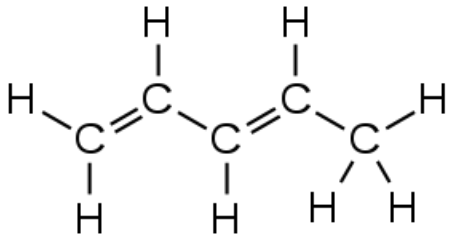


Example 4
Name the alkene pictured below.



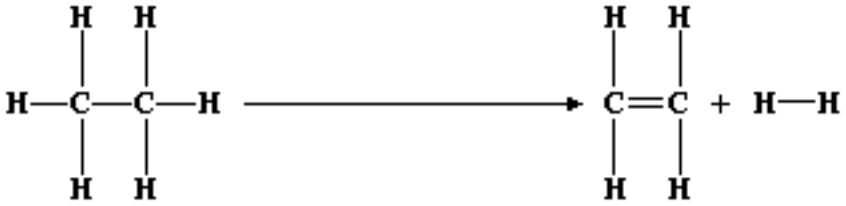
Some alkenes contain more than one double bond. The number of double bonds in such molecules is shown by using a prefix (*di–*, *tri–*, *tetra–*, etc.) before the suffix *–ene*. The positions of the bonds are numbered in a way that gives the lowest set of numbers.

Example 5
Name the alkene pictured below.



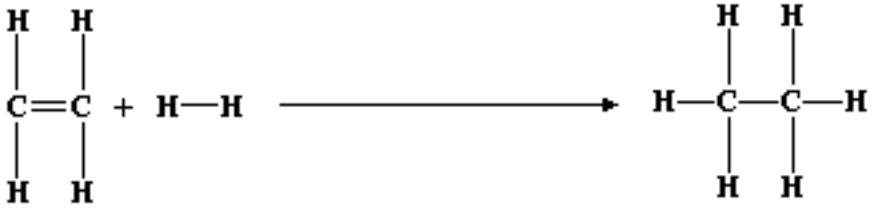
Formation of Alkenes

Dehydrogenation is a chemical process that involves the removal of two hydrogen atoms from an organic molecule. This process can be used to form alkenes from alkanes. When two hydrogen atoms are removed from an alkane, a double bond forms between the two carbons they were removed from.



Dehydrogenation can be accomplished using heat and/or catalysts.

Hydrogenation is the chemical process that involves the addition of two hydrogen atoms to an organic molecule. This process can be used to form alkanes from alkenes. When two hydrogen atoms are added to an alkene, the double bond between two carbons will break. The two hydrogen atoms will attach themselves to the carbon atoms at the site of the double bond.



Hydrogenation is also accomplished using heat and/or catalysts.