

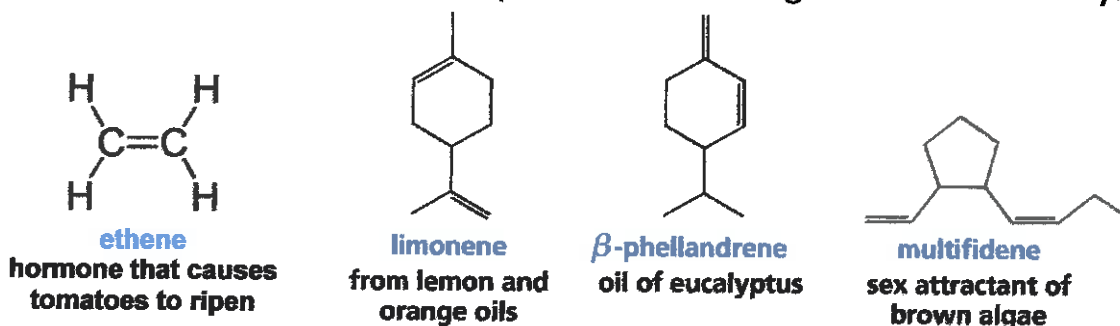
3.0 Alkenes and Alkynes

Alkenes contain one or more double bonds (General formula: C_nH_{2n}).

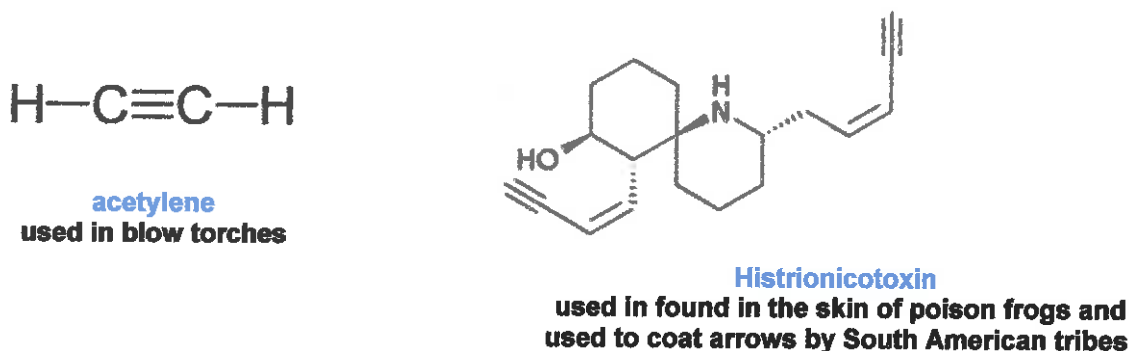
Alkynes contain one or more triple bonds (General formula: C_nH_{2n-2}).

Since alkenes and alkynes are NOT bonded to the maximum possible number of atoms, these compounds are unsaturated hydrocarbons.

Many of the flavors, hormones, and insect pheromones belong to the alkene family.



Alkynes have been used as fuels, poison, or to make plastics and other organic compounds.

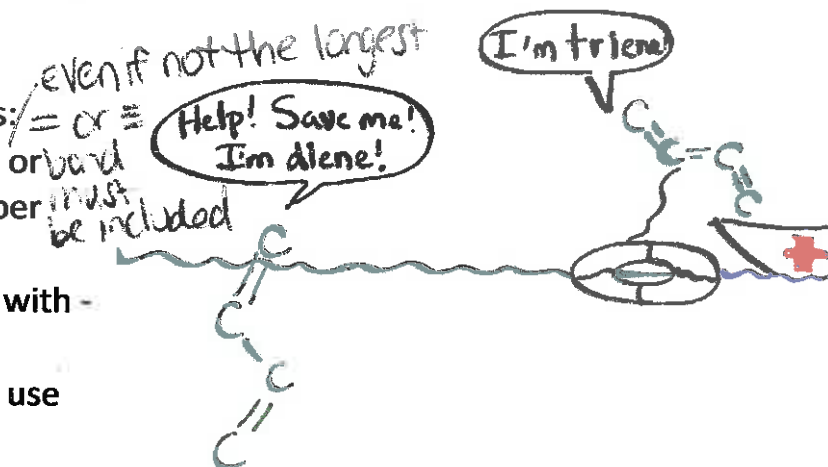


Alkanes, alkenes and alkynes are all aliphatic hydrocarbons, which means their structures are based on straight or branched chains or rings of carbon atoms.

Naming Alkenes and Alkynes

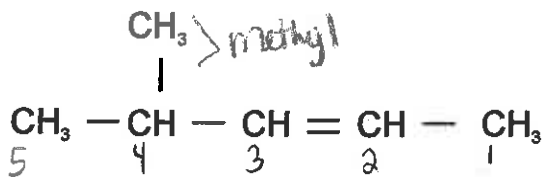
Same as with alkanes but with a few extras:

- The main chain must include double or triple bonds at lowest position number (indicate position #).
- Alkenes end with -ene. Alkynes end with -yne.
- If more than one double bond exists use prefixes (diene, triene, ...)
- When numbering the main chain, double and triple bonds have priority over alkyl groups.



Examples: Name the following

(a)



4-methyl 2-pentene

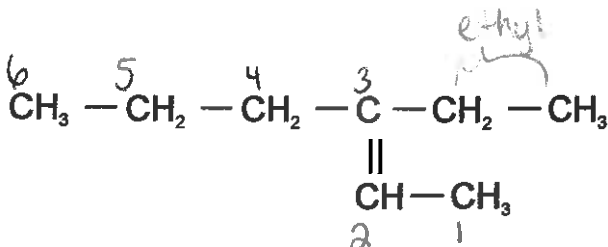
(a) Parent chain

(b) #

(c) name branches

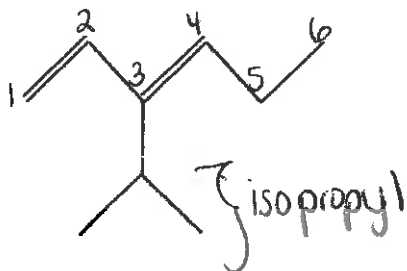
(d) name compound

(b)



3-ethyl 2-hexene

(c)



3-isopropyl-1,3-hexadiene

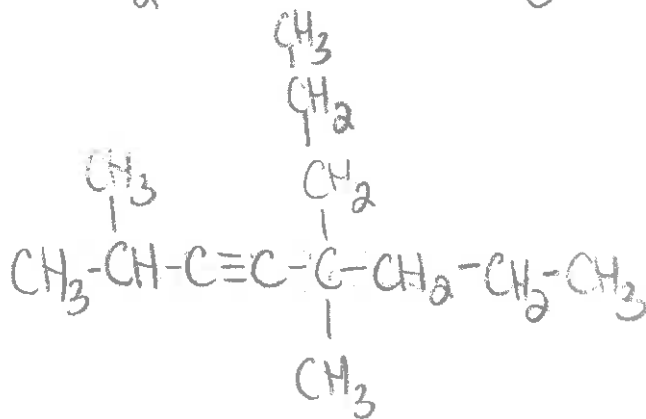
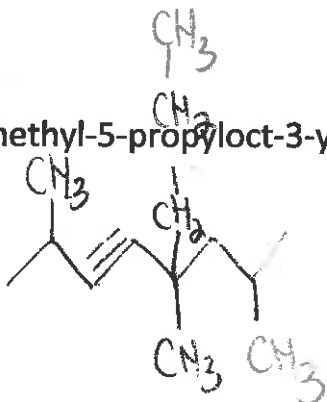
Examples: Draw the following

(a) 2,4-pentadiene

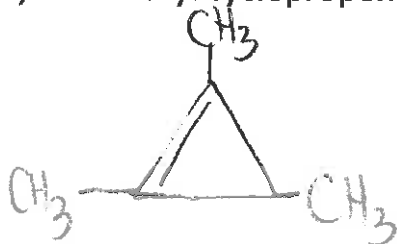
(1,3-pentadiene)



(b) 2,5,7-trimethyl-5-propyloct-3-yne

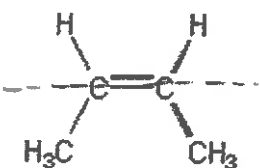


(c) 1,2,3-trimethyl cyclopropene



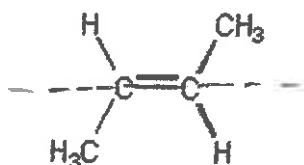
Stereoisomerism

Stereoisomers have the same number of atoms, with the double bond in the same position, but with a different 3D geometry around that double bond.



cis-2-butene

methyl groups
on same side of
 π bond



trans-2-butene

methyl groups
on opposite sides of
 π bond

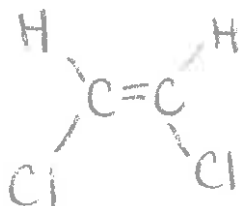
- *Cis-* means that the two groups are on the same side of the double bond

- *Trans-* indicates that they are on opposite sides

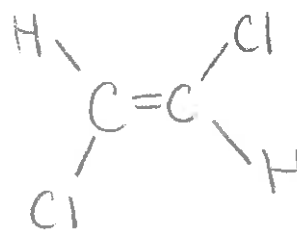
Stereoisomers cannot be changed from one to the other by simple rotation. Bonds would have to be broken and reformed. Stereoisomers are distinct compounds with different properties, such as different melting points.

Example:

(a) *cis-1,2-dichloroethene*



(b) *trans-1,2-dichloroethene*



Properties of Alkenes and Alkynes

A functional group is a group of atoms within a molecule that determines the properties of the molecule.

Multiple bonds are considered functional groups because they affect the properties of the molecules that contain them.

- For example, multiple bonds are less stable than single bonds between carbon atoms, thus alkenes and alkynes are more reactive than alkanes.