

Organic Chemistry

1st stage

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Lecture 4: Alkynes

Department of Medical Physics

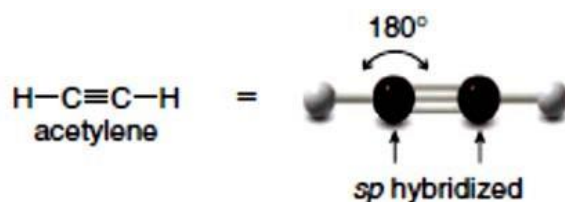
2024-2025

Alkynes

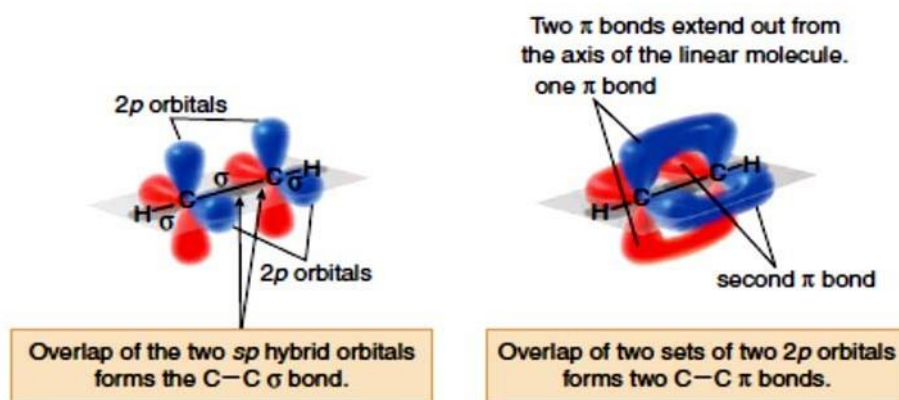
Molecules of alkyne series of hydrocarbon are characterized by having two adjacent carbon atoms joined to one another by a triple bond. The carbon-carbon triple bond is unsaturated and highly reactive toward the reagents that double bonds react with.

The general formula is C_nH_{2n-2} .

Each carbon of a triple bond is sp hybridized and linear, and all bond angles are 180°



The triple bond of an alkyne consists of one σ bond and two π bonds.



$\text{HC} \equiv \text{CH}$	Ethyne (acetylene)
$\text{HC} \equiv \text{CCH}_3$	Propyne
$\text{HC} \equiv \text{CCH}_2\text{CH}_3$	1-Butyne
$\text{HC} \equiv \text{C}(\text{CH}_2)_2\text{CH}_3$	1-Pentyne
$\text{HC} \equiv \text{C}(\text{CH}_2)_3\text{CH}_3$	1-Hexyne
$\text{HC} \equiv \text{C}(\text{CH}_2)_4\text{CH}_3$	1-Heptyne
$\text{HC} \equiv \text{C}(\text{CH}_2)_5\text{CH}_3$	1-Octyne
$\text{HC} \equiv \text{C}(\text{CH}_2)_6\text{CH}_3$	1-Nonyne
$\text{HC} \equiv \text{C}(\text{CH}_2)_7\text{CH}_3$	1-Decyne

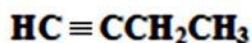
Nomenclature

The alkynes are named according to two systems. In one, they are considered to be derived from acetylene by replacement of one or both hydrogen atoms by alkyl group.

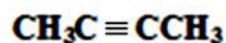


For more complicated alkyne the IUPAC names are used. The rules are exactly as for the alkenes, except that the ending **-yne** is used in place of **-ene**.

Examples



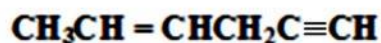
1-Butyne



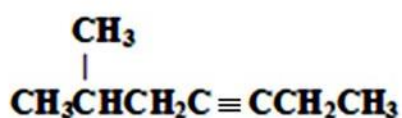
2-Butyne



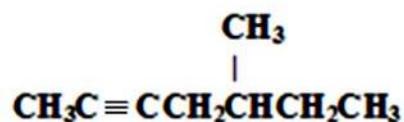
2-Pentyne



4-Hexen-1-yne



6-Methyl-3-heptyne



5-Methyl-2-heptyne

Physical Properties of Alkynes

1. Alkynes are low-polarity compounds with physical properties similar to alkanes and alkenes.
2. They are insoluble in water but dissolve in low-polarity organic solvents such as ether, benzene, and carbon tetrachloride.
3. They are less dense than water.
4. Their boiling points increase with the number of carbon atoms
5. Acetylene ($\text{HC} \equiv \text{CH}$) is a colorless gas with an ethereal odor that burns in oxygen to form CO_2 and H_2O .
6. The combustion of acetylene releases more energy per mole of product than other hydrocarbons.
7. It burns with a very hot flame, making it an excellent fuel for welding.