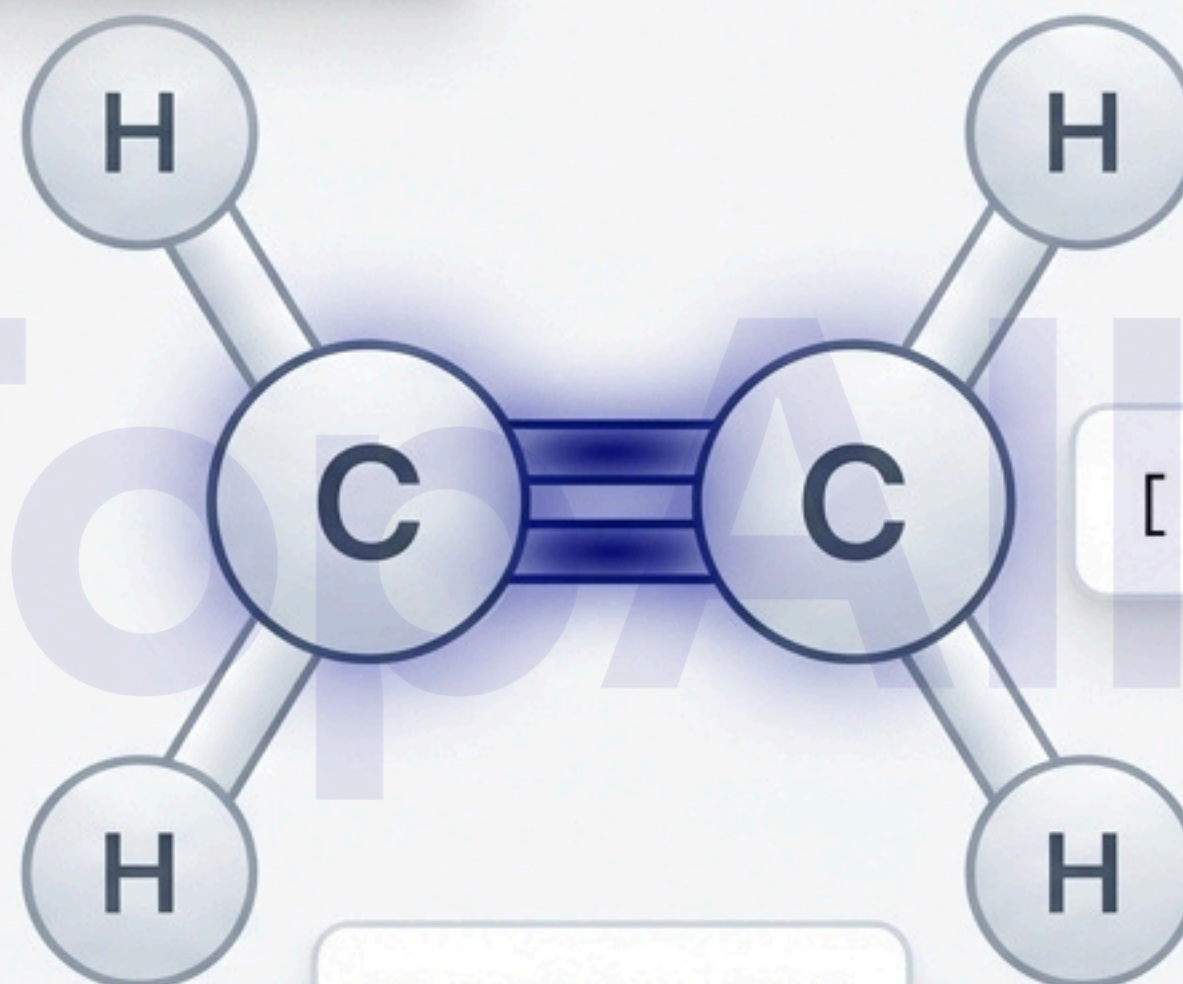


Alkenes

The Chemistry of Unsaturated Hydrocarbons

An essential guide to double bonds, orbital structures, and chemical reactivity.

[Unsaturated]



[Olefins]

[C=C Bond]

The Nature Of Unsaturated Hydrocarbons

Alkenes are a crucial class of hydrocarbons defined by a specific structural feature: they contain at least one carbon-carbon double bond.



Unsaturation

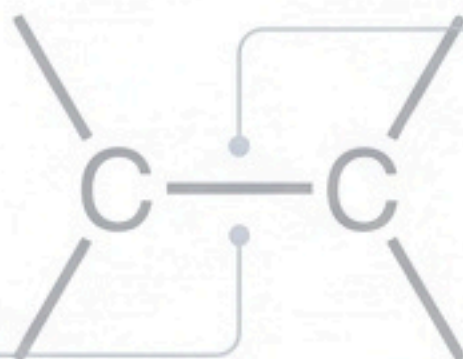
Unlike alkanes (which hold the maximum possible hydrogens), alkenes are unsaturated because the double bond reduces the total number of hydrogen atoms.



The Olefins

Historically known as olefins (oil-forming). The first member, ethene, formed an oily liquid when reacted with chlorine gas.

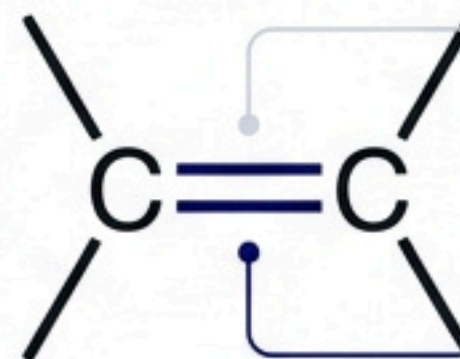
Alkane



Single Bond

C-C single bond, 154 pm

Alkene

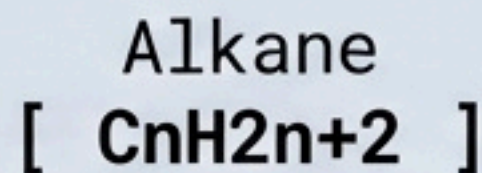


Double Bond

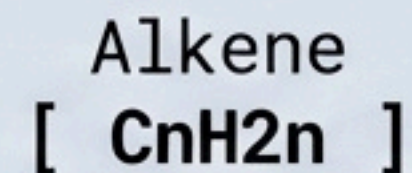
C=C double bond, 134 pm

The Math Of The Double Bond

Because every double bond replaces two single carbon-hydrogen bonds, alkenes systematically possess two fewer hydrogen atoms than their corresponding alkanes.



- 2H (Formation of one double bond)



Where n = number of carbon atoms.
(e.g., If $n=3$, the formula is C_3H_6 , known as Propene).



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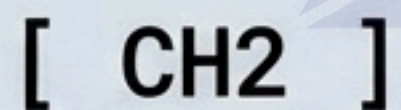
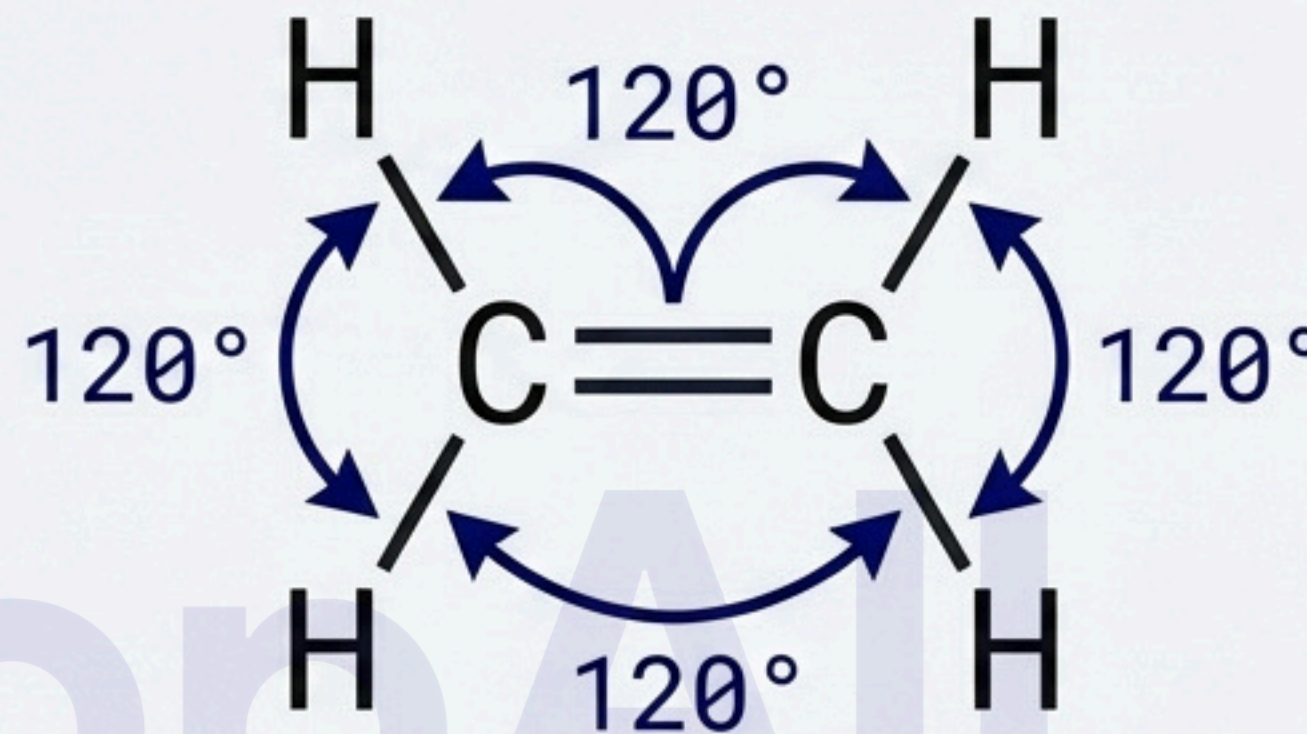
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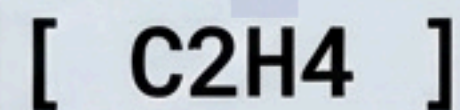
Ethene: The First Stable Member

While the general formula suggests a 1-carbon alkene could exist, the reality of chemical bonding dictates otherwise. The series officially begins with a 2-carbon molecule.



Why not Methene?

A one-carbon alkene (methene) has a very short life and is highly unstable because a carbon atom cannot form a double bond with itself.



Ethene / Ethylene

The simplest and first stable member of the series. Features two carbon atoms sharing a double bond, flanked by four hydrogens.

The Power And Vulnerability Of The Double Bond

Alkenes are highly reactive compared to inert alkanes. This reactivity is entirely driven by the specific orbital anatomy of the carbon-carbon double bond.

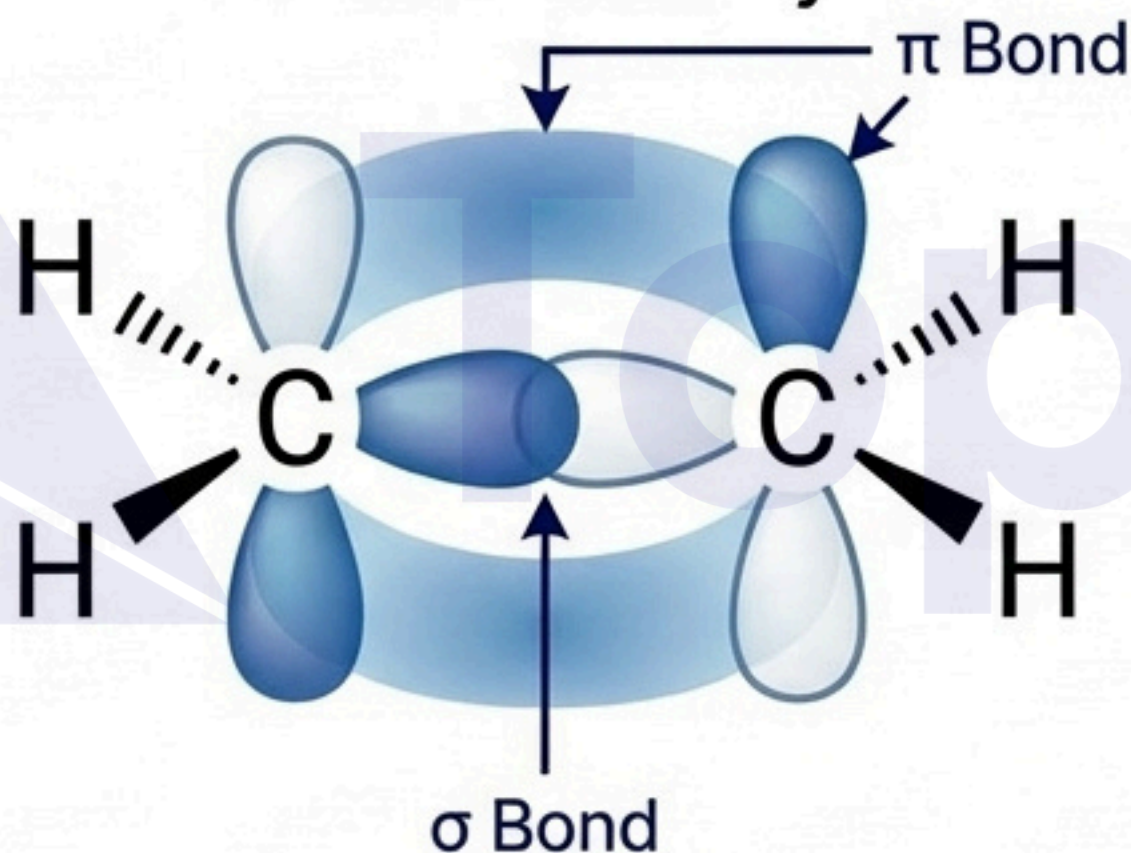
The Strong Core

[Sigma (σ) Bond]

397 kJ/mol

Formed by head-on sp^2 orbital overlap. Highly stable.

Orbital Anatomy



The Vulnerable Cloud

[Pi (π) Bond]

284 kJ/mol

Formed by sideways 2p orbital overlap. A weaker bond creating a cloud of loosely held, mobile electrons.

Key Takeaway: Because the π bond is weak and exposed, alkenes act as targets for **Electrophilic Reagents** (electron-seeking molecules), making them **highly chemically reactive**.

Key Takeaways: 9.3 Alkenes

Master these four fundamental concepts of the alkene family.

[Unsaturation]

The Structure

Hydrocarbons containing at least one Carbon-Carbon double bond (C=C).

[C_nH_{2n}]

The Formula

Possess exactly two fewer hydrogen atoms than saturated alkanes (C_nH_{2n+2}) due to the double bond.

[Olefins]

The Name

Historically called olefins (oil-forming). Nomenclature replaces the alkane -ane suffix with -ene.

[The Pi Bond]

The Reactivity

The weaker, exposed π bond makes alkenes highly susceptible to electrophilic attack and addition reactions.

[Alkane: Single Bond, Inert]

[Alkene: Double Bond, Reactive]



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