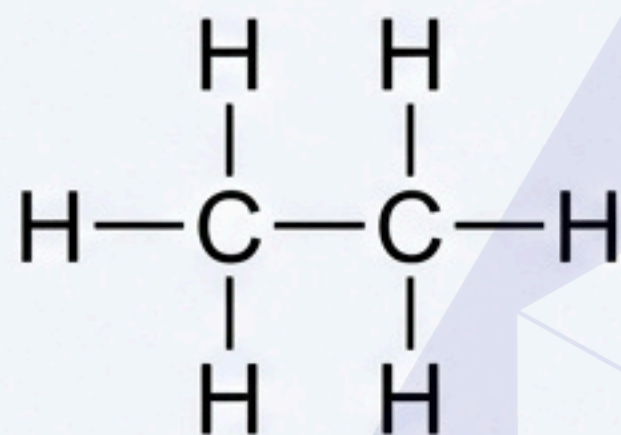


Carbon Hybridisation Overview

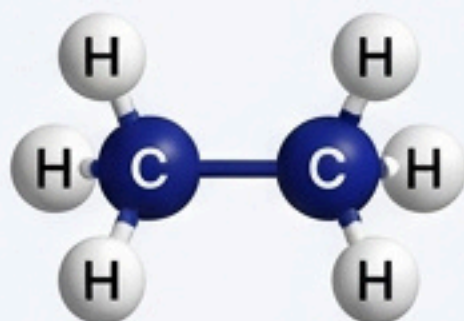
Comparing the structural blueprints of two-carbon hydrocarbons.

Ethane (C_2H_6)

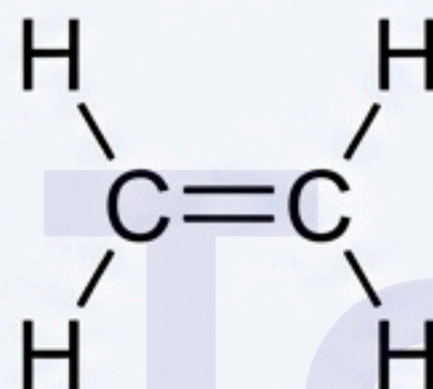


sp^3

- All σ (sigma) bonds

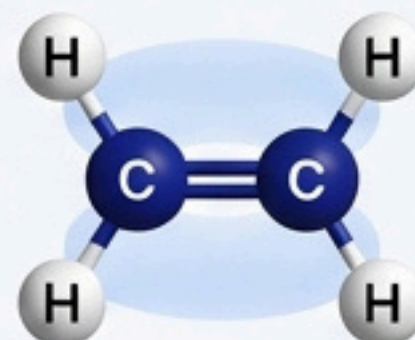


Ethene (C_2H_4)

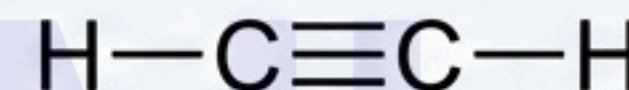


sp^2

- 1 σ + 1 π (pi) bond

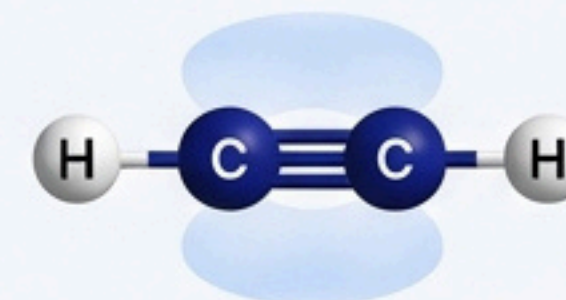


Ethyne (C_2H_2)



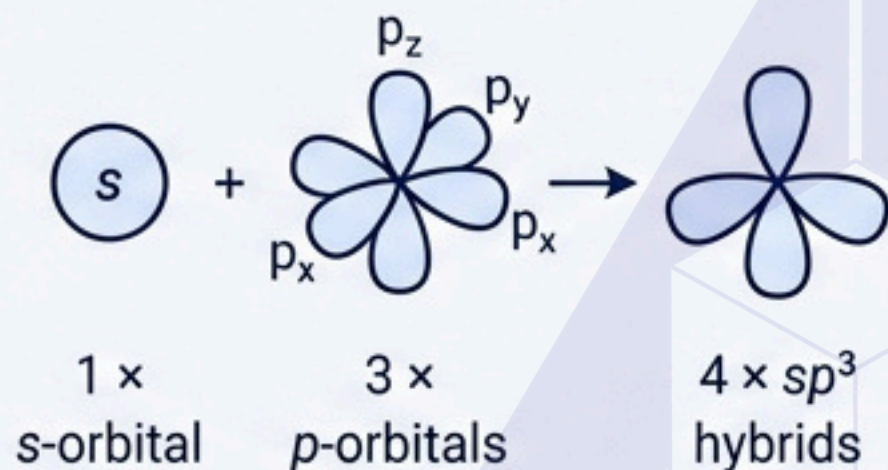
sp

- 1 σ + 2 π (pi) bonds



C_2H_6 : The sp^3 Hybridisation

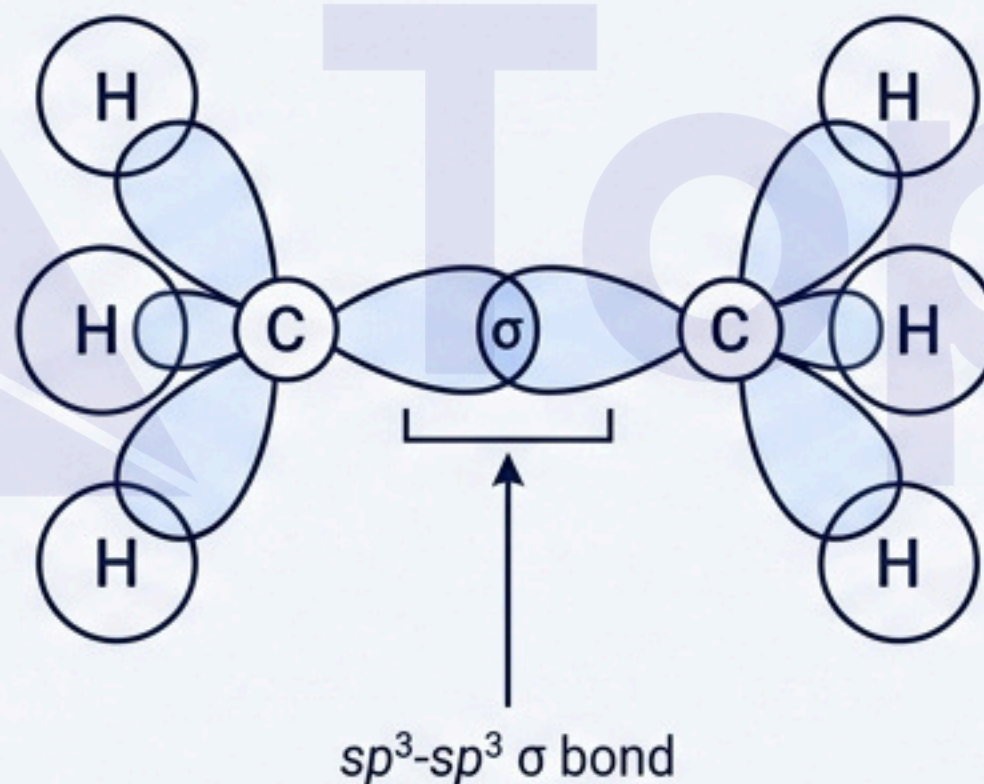
The Blueprint



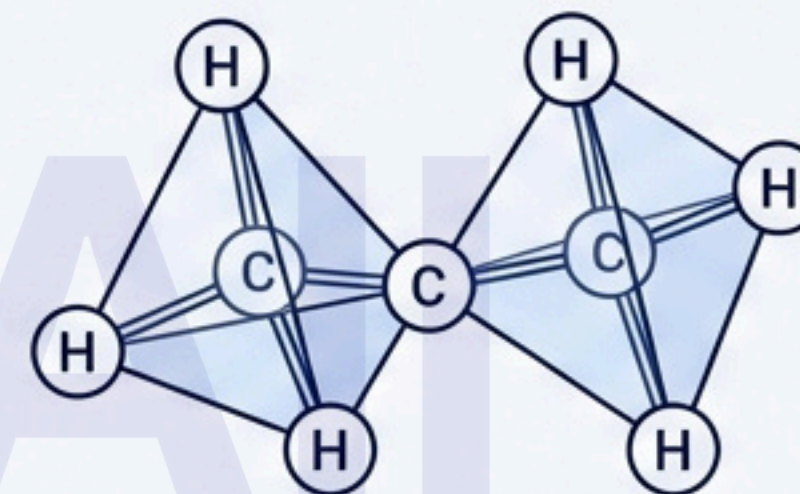
25% s-character / 75% p-character

One 2s and three 2p orbitals of the carbon atom intermix to form four equivalent sp^3 hybrid orbitals directed toward the corners of a tetrahedron.

The Construction



The Result



{ Geometry: Tetrahedral }

{ Bond Angle: 109.5° }

{ C-C Length: 154 pm }

{ C-H Length: 109 pm }

C₂H₄: The sp^2 Hybridisation

The Blueprint

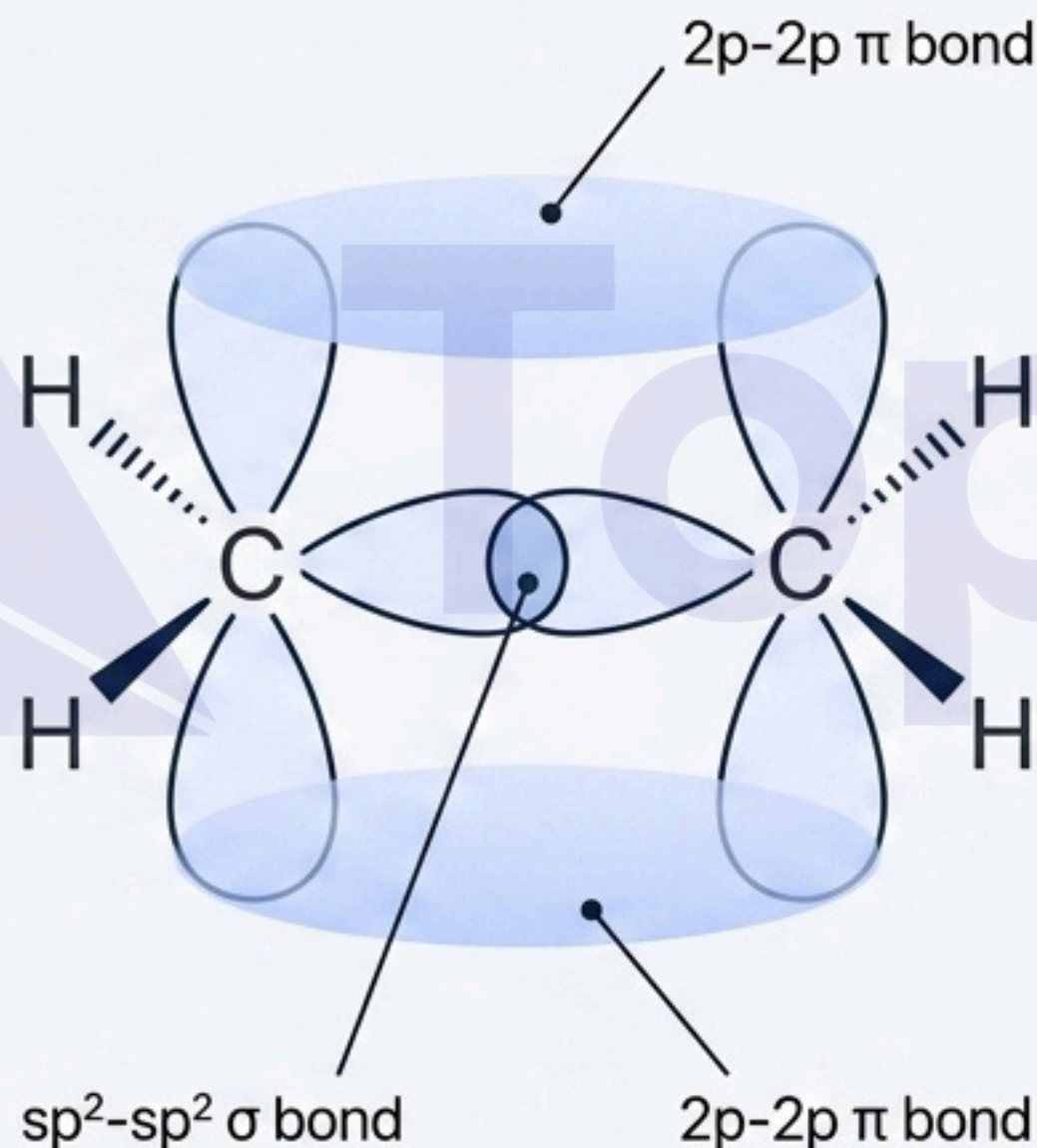


3 $\times$ sp^2 hybrids +

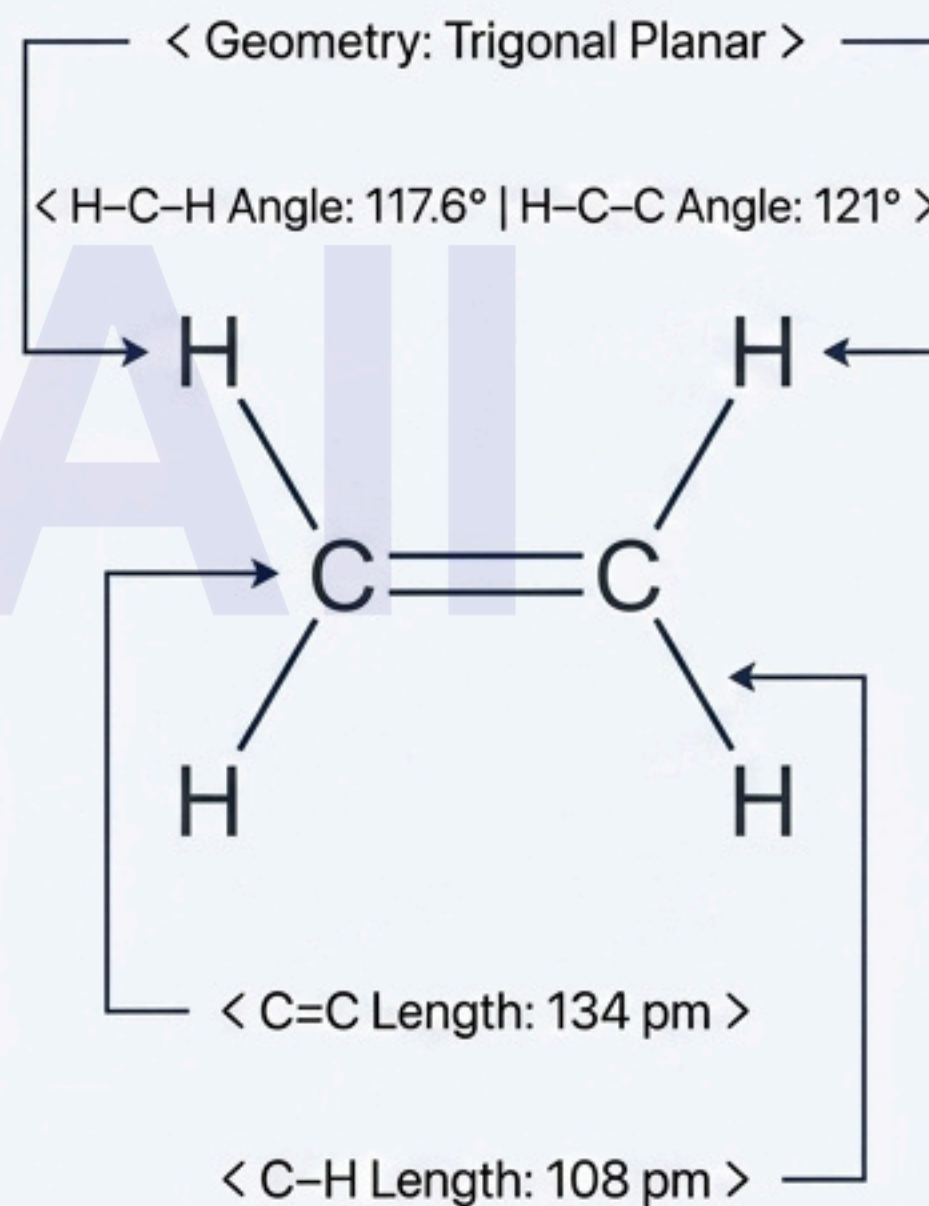
1 unhybridized p-orbital

33%
s-character

The Construction



The Result





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$$E=mc^2$$



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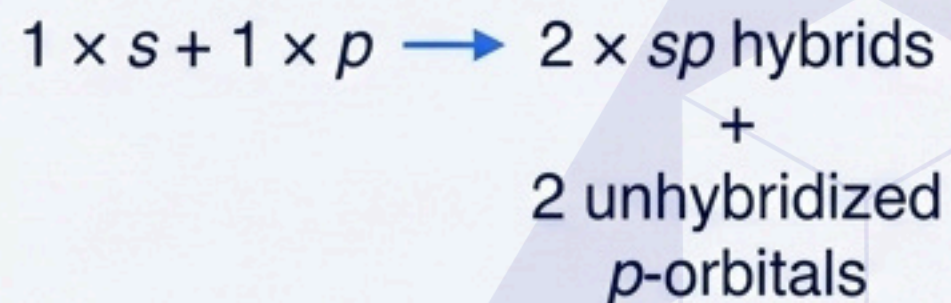
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- » Track Your Performance Smarter



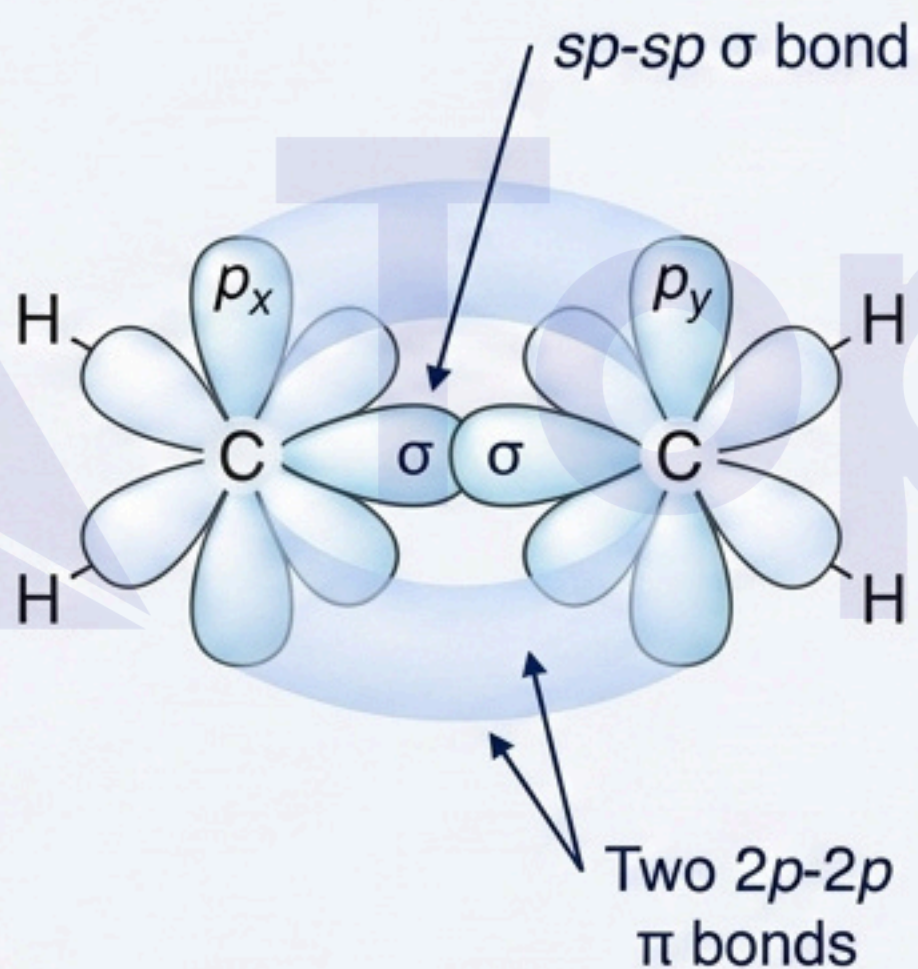
C_2H_2 : The sp Hybridisation

The Blueprint

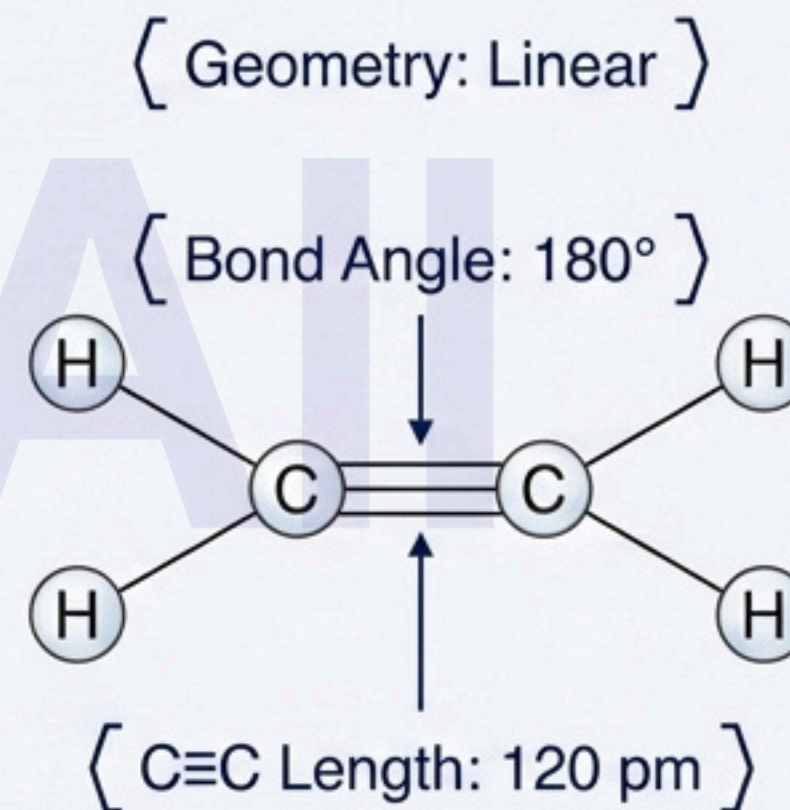


50% s -character

The Construction



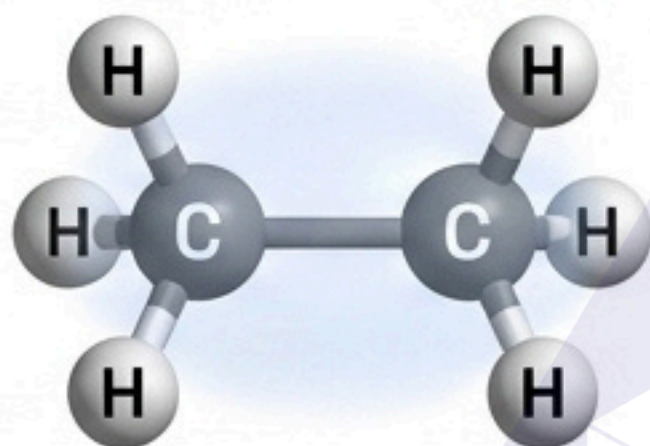
The Result



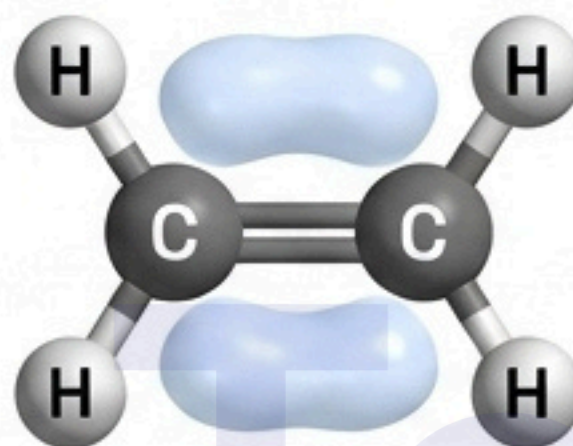
The Bond Length Trend

How orbital mixing and π bonds pull atoms closer together

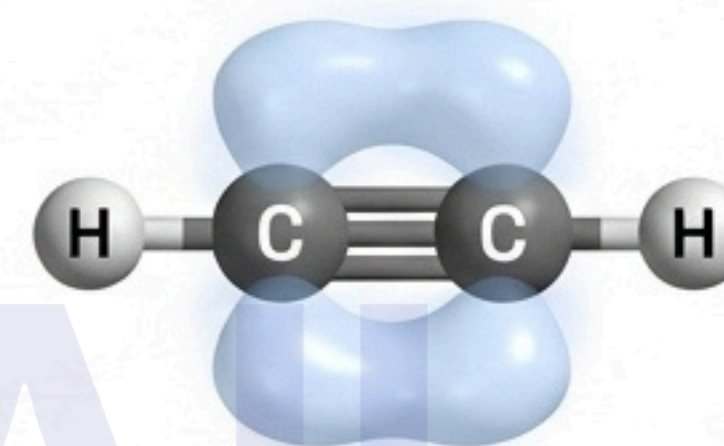
Ethane: 154 pm



Ethene: 134 pm



Ethyne: ~120 pm



1. The s-Character Effect

As s-character increases (25% $\rightarrow$ 33% $\rightarrow$ 50%), the hybrid orbitals become smaller and are held closer to the nucleus, shortening the σ bond.

2. The π Bond Effect

The addition of π bonds (0 $\rightarrow$ 1 $\rightarrow$ 2) increases the electron density between the two carbon nuclei, pulling them tighter together and increasing overall bond strength.

Revision Frame: Carbon Hybridisation

Vital statistics for sp^3 , sp^2 , and sp carbon centers.

	Ethane (sp^3)	Ethene (sp^2)	Ethyne (sp)
Orbital Mixing	$1s + 3p$	$1s + 2p$	$1s + 1p$
% s-character	25%	33%	50%
Geometry & Angle	Tetrahedral (109.5°)	Trigonal Planar ($\sim 120^\circ$)	Linear (180°)
Unhybridized p-orbitals	0	1	2
Carbon-Carbon Bond	1σ	$1 \sigma + 1 \pi$	$1 \sigma + 2 \pi$



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