

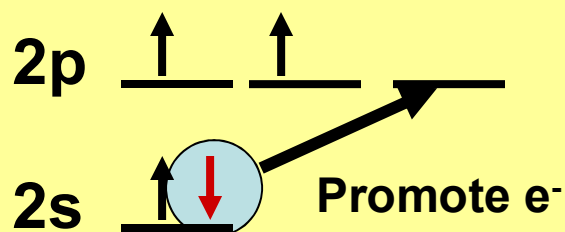
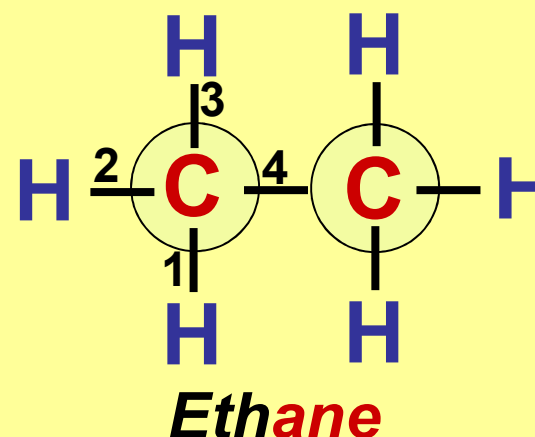
Valence Bond Theory:

Multi-Center Atoms

CH₃CH₃: *Tetrahedral (sp³)*

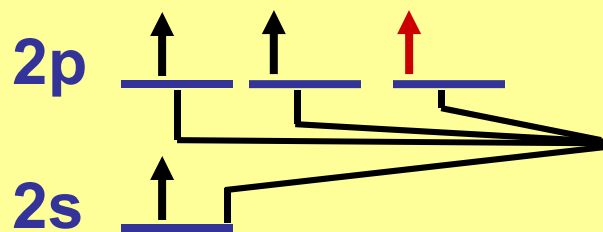
C: *e⁻ configuration:* $1s^2 2s^2 2p^2$

Two Centers!



Ground State
E-Level Diag

2 unpaired e⁻ ⇒
2 possible bonds!



Promoted State
E-Level Diag

4 unpaired e⁻ ⇒
4 possible bonds

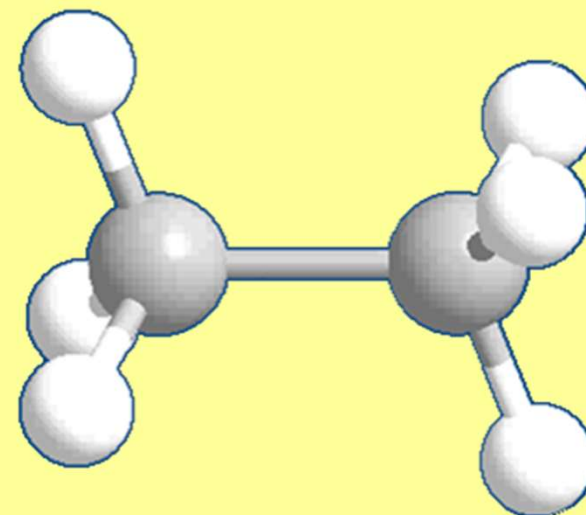
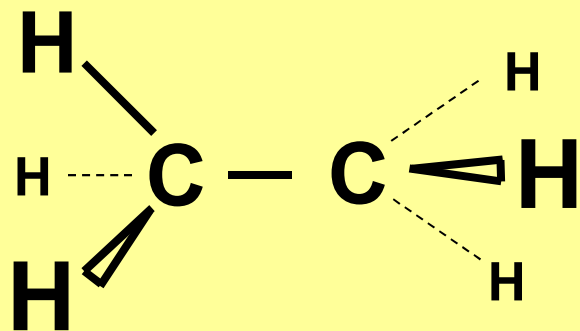


Hybrid State
E-Level Diag

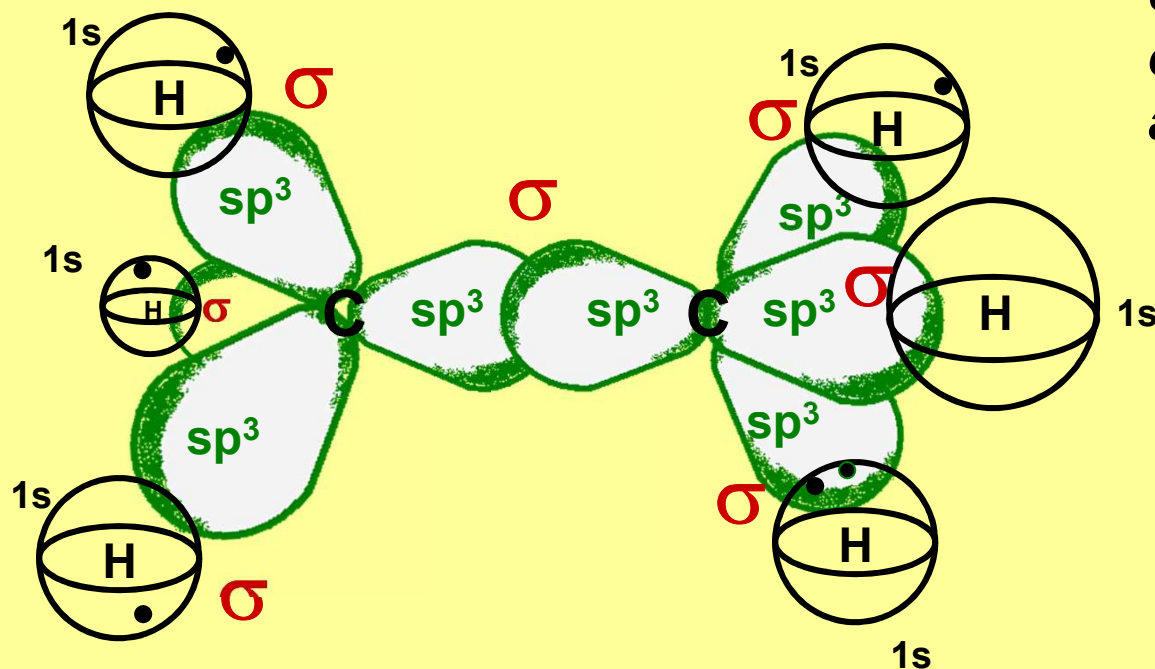
4 sp³ hybrid levels
form 4 bonds



Valence Bond Theory: Multi-center atoms



Single bond between the carbons permits rotation about this bond.



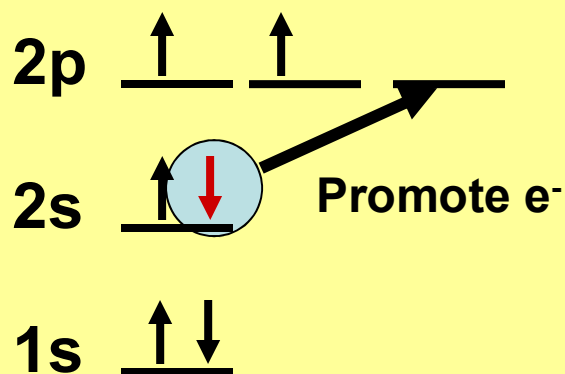
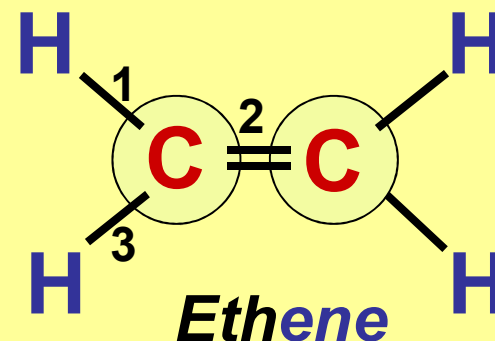
Valence Bond Theory:

Multi-Center Atoms

CH₂CH₂: Trig. Planar (sp^2)

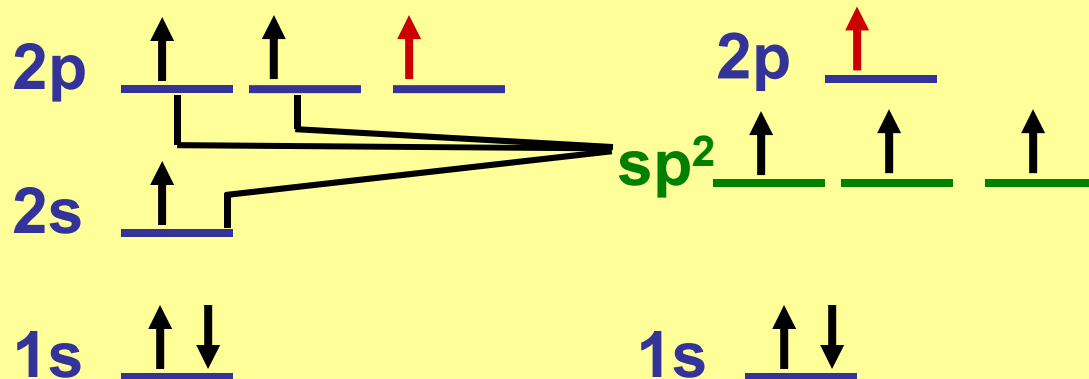
C: e^- configuration: $1s^2 2s^2 2p^2$

Two Centers!



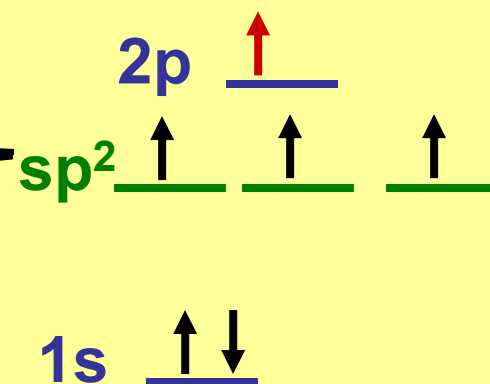
Ground State

2 unpaired $e^- \Rightarrow$
2 possible bonds!



Promoted State

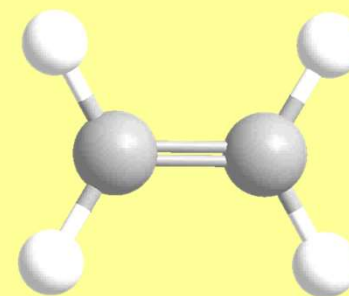
4 unpaired $e^- \Rightarrow$
4 possible bonds



Hybrid State

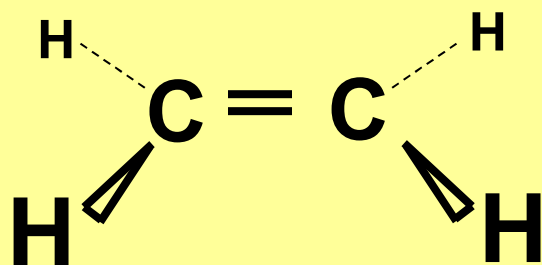
3 sp^2 hybrid levels
1 Un-hybridized
atomic 2p orbital! 💡

Valence Bond Theory: Multi-center atoms

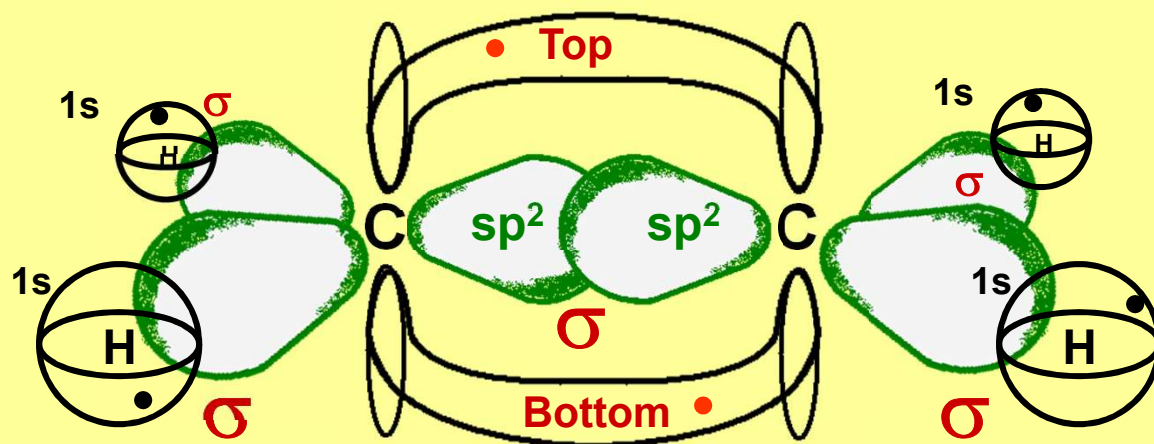


Ethene

Double bond makes it very difficult for molecule to rotate about the C=C bond



Off-axis π bond



Un-hybridized 2p orbitals



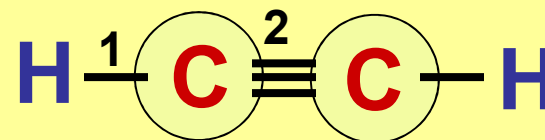
Valence Bond Theory:

Multi-Center Atoms

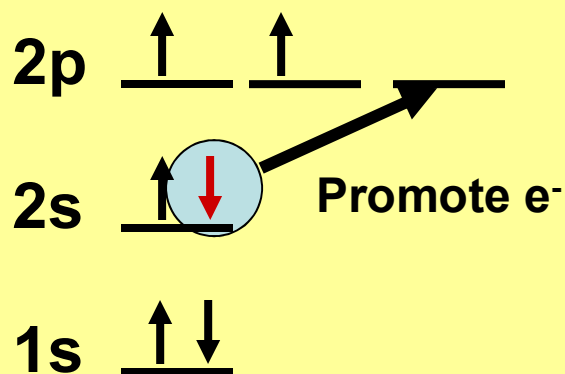
CHCH: *Linear (sp)*

C: *e*⁻ configuration: $1s^2 2s^2 2p^2$

Two Centers!

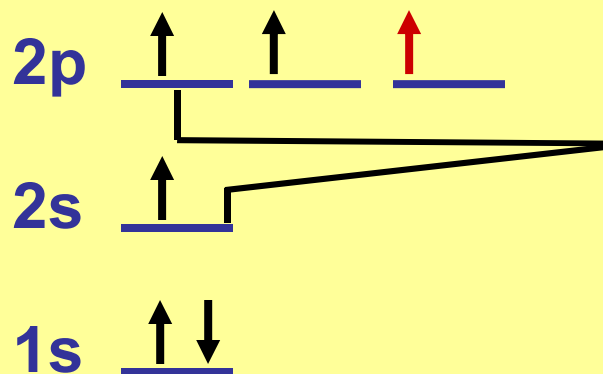


Ethyne



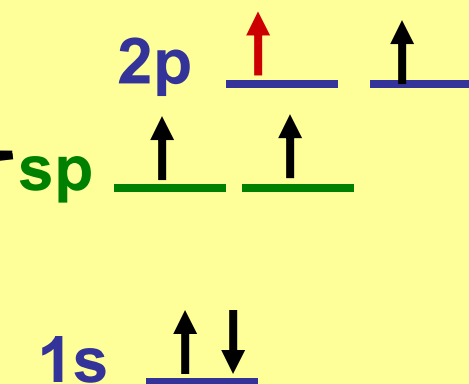
Ground State

2 unpaired $e^- \Rightarrow$
2 possible bonds!



Promoted State

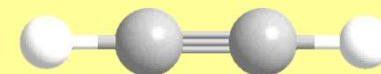
4 unpaired $e^- \Rightarrow$
4 possible bonds



Hybrid State

2 sp hybrid levels
2 Un-hybridized
atomic 2p orbitals!

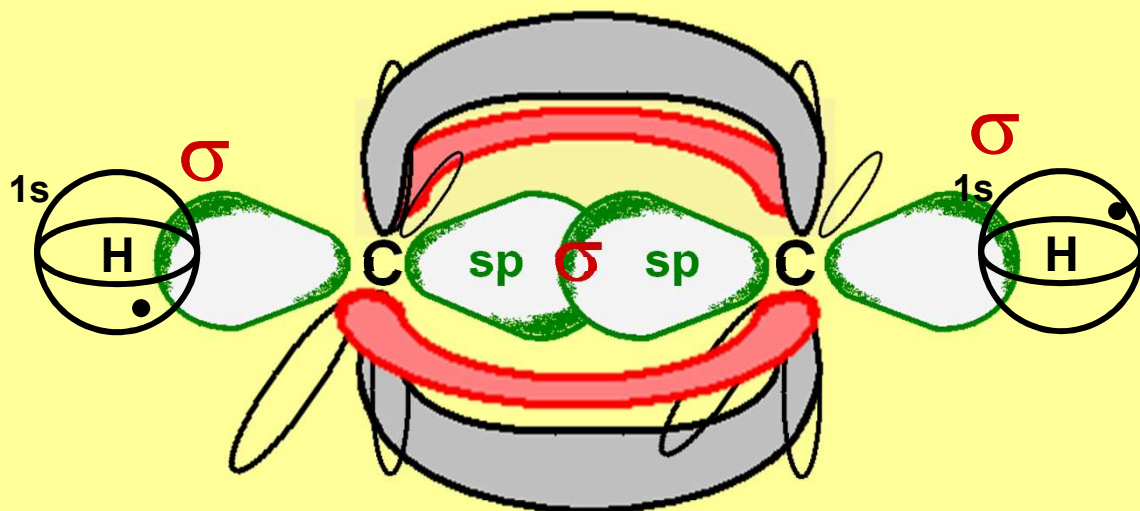
Valence Bond Theory: Multi-center atoms



Ethyne

Triple bond makes the ethyne molecule very rigid, and difficult to bend.

2 Off-axis π bonds



Un-hybridized 2p orbitals

