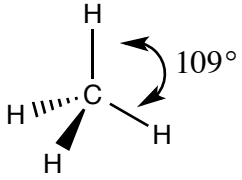
Representation of Molecules

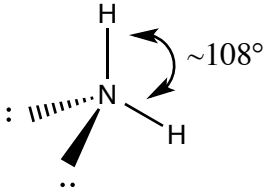
- Show only electrons in outer (valence) shell
- Non-bonding electrons may or may not be shown
- Use element symbols, but carbon can be represented by point of angle or end of line
- Hydrogens and bonds to them from carbon are optional; show others.
- Each line in a structure represents 2 e^-
- Solid wedge ( ): Toward you / out of the page
- Dashed wedge ( ): Away from you / into the page

sp^3 Hybridization

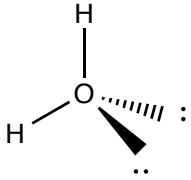
- Single bonds
- Tetrahedral geometry
- Angle between two H atoms: 109°
- Often free rotation around single bonds
- Overlap of atomic orbitals with s component gives sigma molecular orbital (bond)



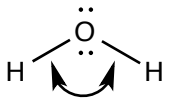
CH_4 - Methane



NH_3 - Ammonia



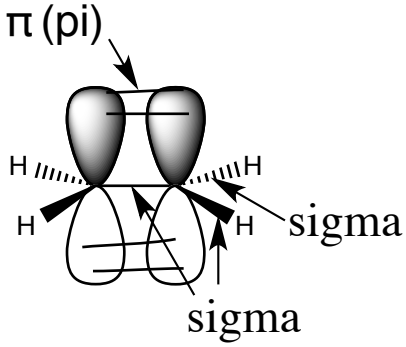
H_2O - Water

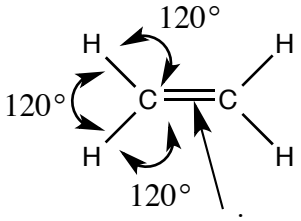


~109°

sp^2 Hybridization

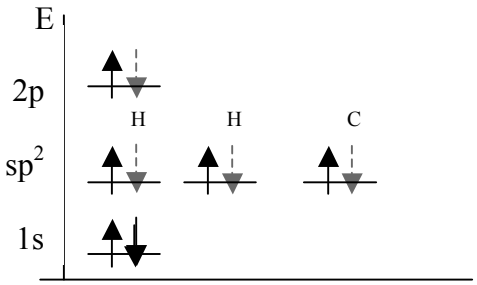
- Double bonds
- Planar geometry
- Angle between two atoms: 120°
- No free rotation around double bonds
- Overlap of atomic orbitals with s component gives sigma molecular orbital (bond)
- Overlap of p atomic orbitals with s component gives pi molecular orbital (bond)

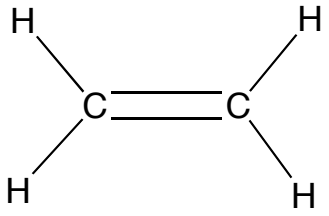




ethylene = ethene

sigma + pi = double bond





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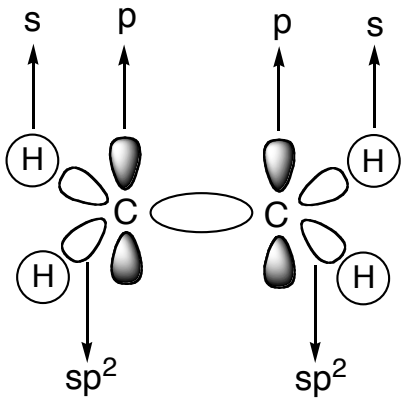
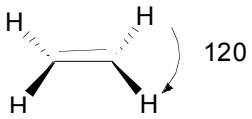
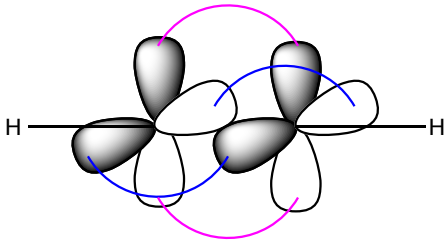




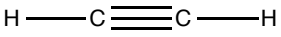
- When atomic orbitals overlap they form molecular orbitals.
- Double bond contains one σ bond and one π bond.
- σ bond has free rotation.
- π bond fixes geometry, does not allow for around the double bond.

sp Hybridization

- Triple bonds
- Linear geometry
- No free rotation around triple bonds



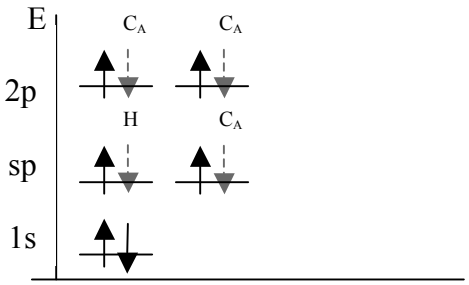
Triple bond:
One sigma bond between the carbons plus two pi bonds formed through p_y and p_z



acetylene = ethyne

<u>sp Hybridization</u>

- Triple bonds
- Linear geometry
- No free rotation around triple bonds
- Angle between two atoms: 180^o



e.g.) Acetylene/Ethyne