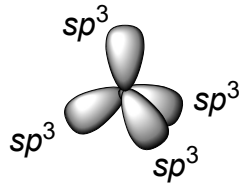
California State Polytechnic University, Pomona

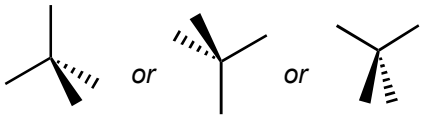
Organic Chemistry I, CHM 3140, Dr. Laurie S. Starkey

Hybridization of Carbon Atoms

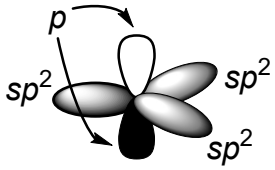
sp^3-hybridized



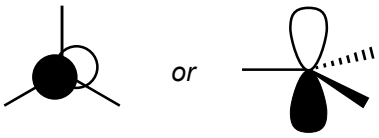
4 regions of electron density
- *sp*^{3} hybrid orbitals
- tetrahedral geometry
- 109.5^o bond angles



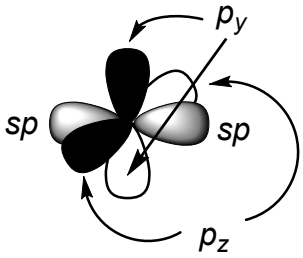
sp^2-hybridized



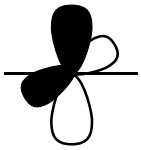
3 regions of electron density
- *sp*^{2} hybrid orbitals
- one *p* orbital remains
- trigonal planar geometry
- 120^o bond angles



sp-hybridized

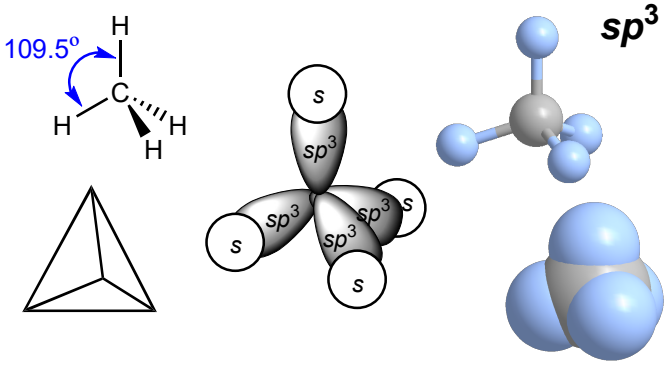


2 regions of electron density
- *sp* hybrid orbitals
- two *p* orbitals remain
- linear geometry
- 180^o bond angle



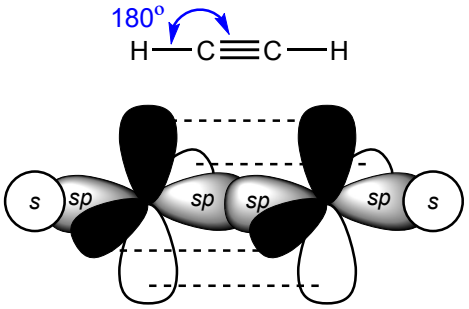
3D Orientation of Sigma (σ) and Pi (π) Bonds

sp^3

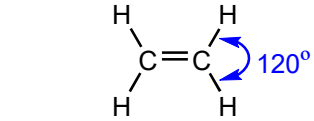


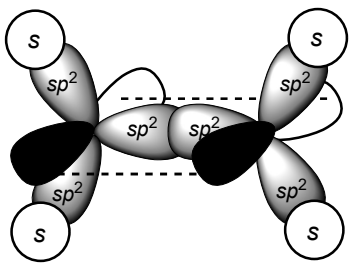
Tetrahedral orientation of sigma bonds in methane (***sp*^{3} hybridization**).

sp



Linear orientation of sigma bonds in acetylene (***sp* hybridization**). Overlapping *p* orbitals form two pi bonds.





Trigonal planar orientation of sigma bonds in ethylene (***sp*^{2} hybridization**). A pi bond is formed by overlapping *p* orbitals that are orthogonal to *sp*^{2} plane.

sp^2