

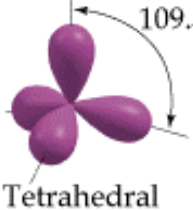


Hybridization

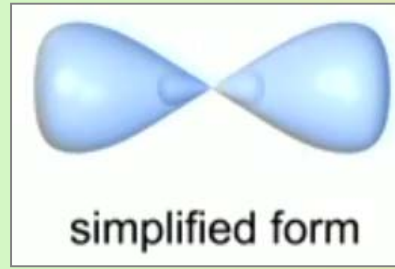
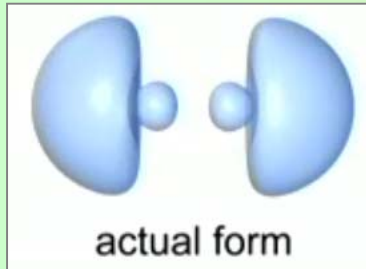
Introduction

How do the shapes of the molecules arise from the atomic orbitals?

The hybridization concept proposes a model in which the atomic orbitals s and p are mixed to become hybrid orbitals

Atomic Orbital Set	Hybrid Orbital Set	Geometry	Examples
s, p	Two sp	 Linear	BeF_2 , HgCl_2
s, p, p	Three sp^2	 Trigonal planar	BF_3 , SO_3
s, p, p, p	Four sp^3	 Tetrahedral	CH_4 , NH_3 , H_2O , NH_4^+

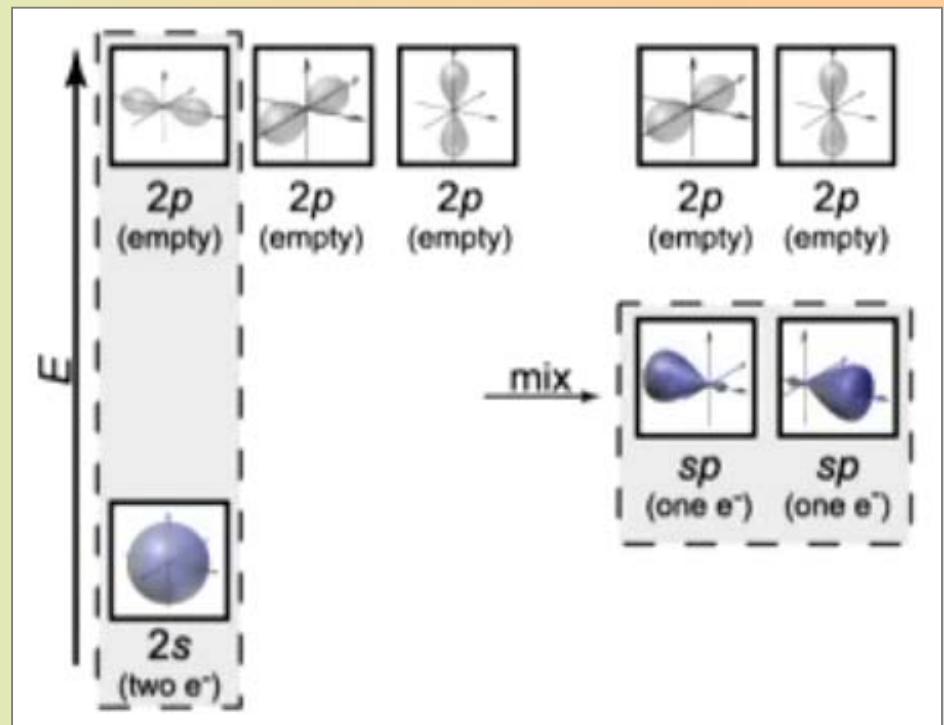
Hybridization



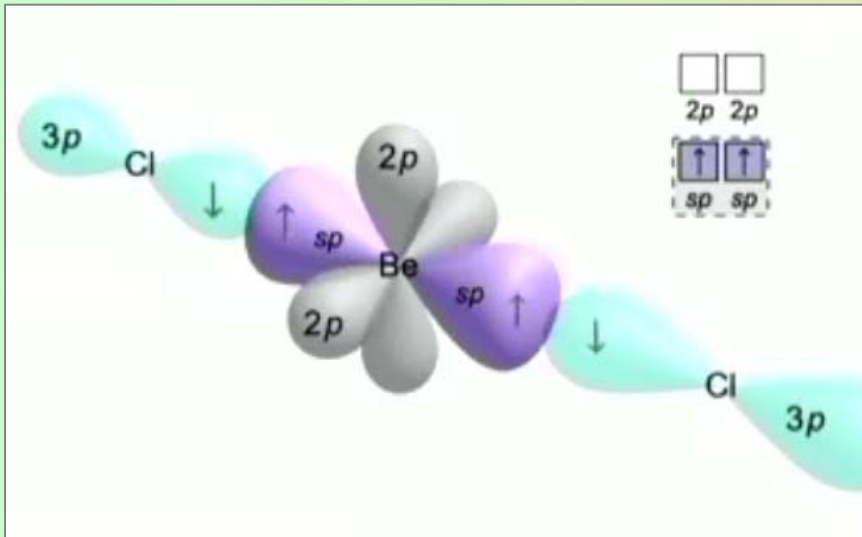
In the case of beryllium the filled 2s orbital and an empty 2p orbital mix to be transformed into two sp orbitals. The other two 2p orbitals remain unhybridized.

sp hybridization

When one **s** and **one p** orbital mix they become **two sp** hybrid atomic orbitals. The angle between them is 180° .



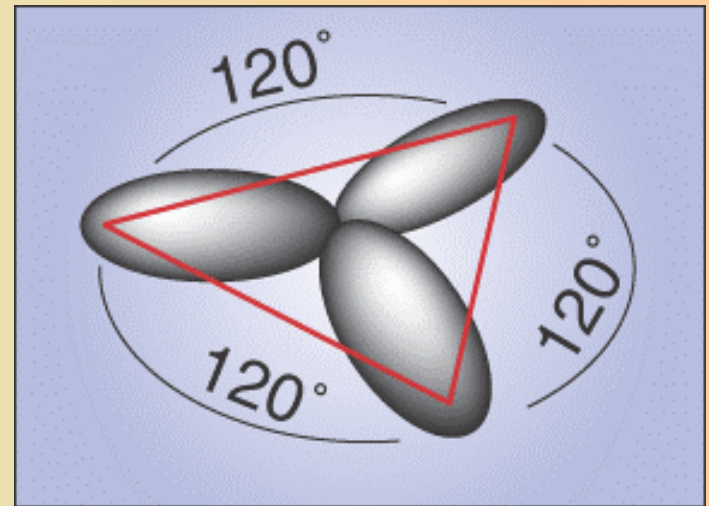
Hybridization



When beryllium combines with two chlorine atoms the molecule adopts a linear shape.

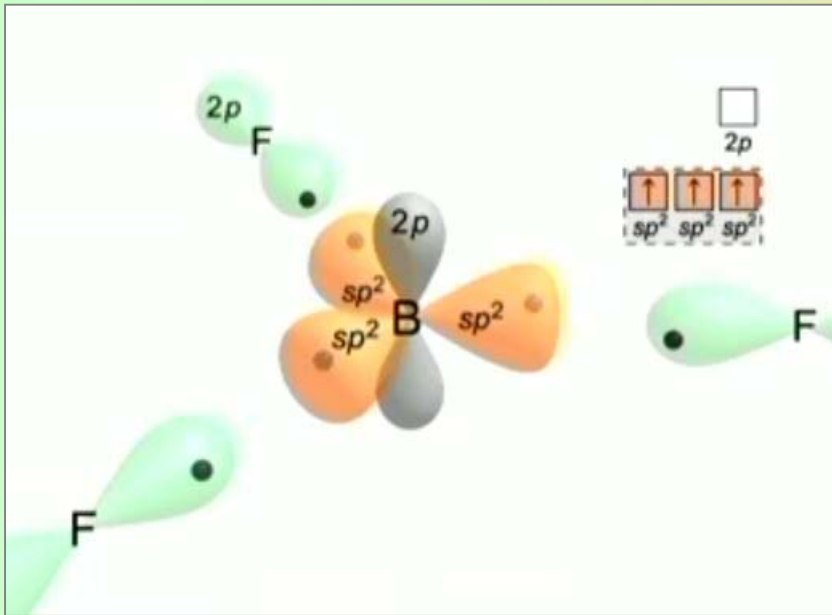
sp² hybridization

When one **s** and **two p** orbitals mix they become **three sp²** hybrid atomic orbitals. The angle between them is 120°.



<http://upload.wikimedia.org/wikipedia/commons/8/8c/Sp2-Orbital.png>

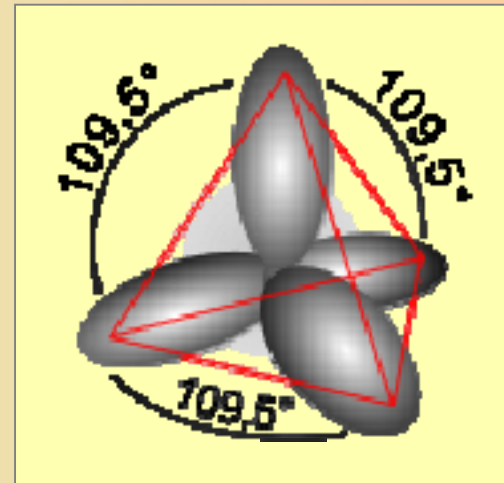
Hybridization



When boron combines with three fluorine atoms the molecule adopts a trigonal planar shape.

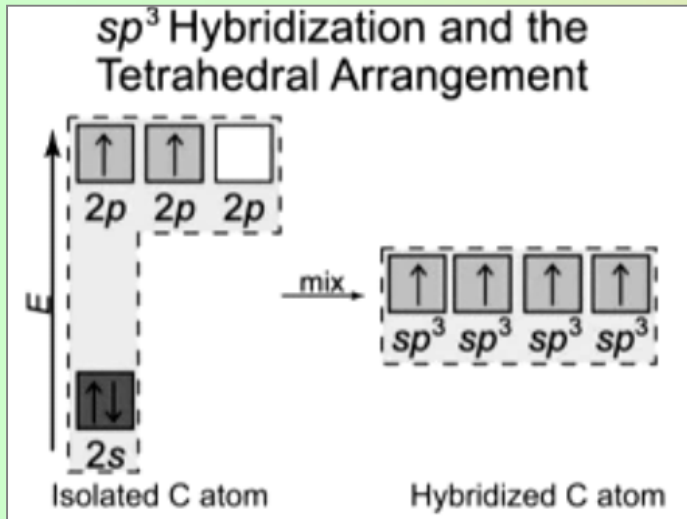
sp^3 hybridization

When one **s** and **three p** orbitals mix they become **four sp^3** hybrid atomic orbitals. The angle between them is 109.5° .

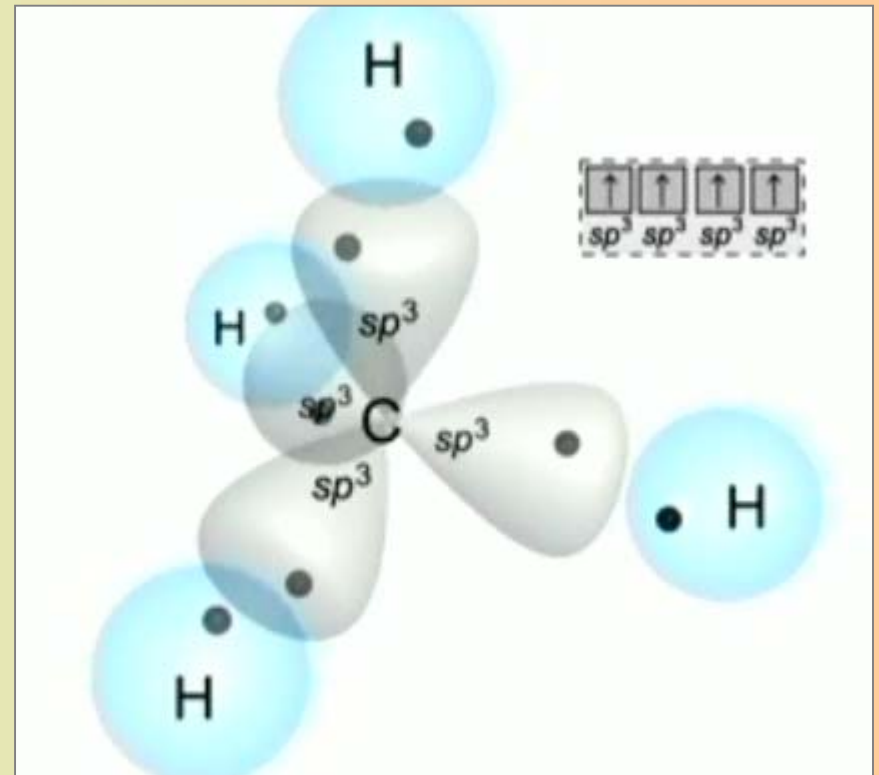


<http://upload.wikimedia.org/wikipedia/commons/thumb/9/9f/Sp3-Orbital.svg/150px-Sp3-Orbital.svg.png>

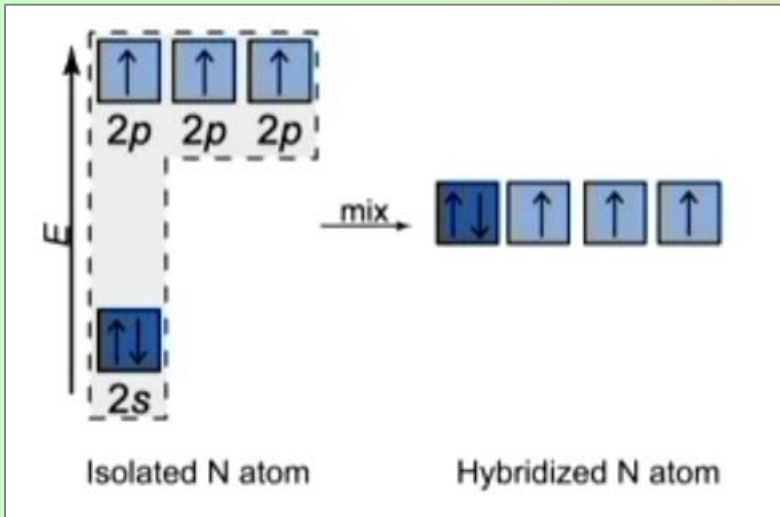
Hybridization



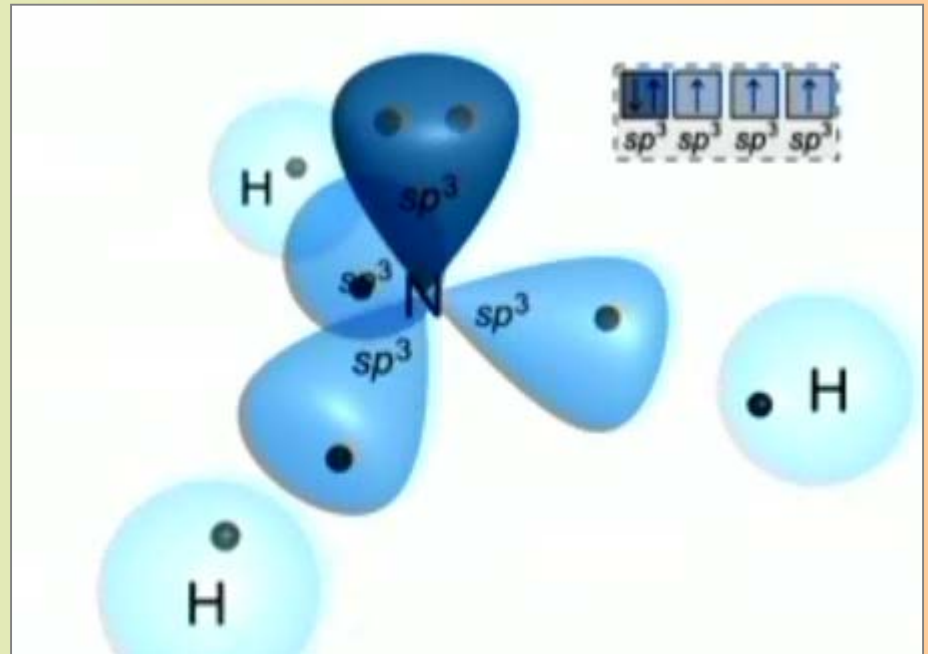
When carbon combines with four hydrogen atoms the molecule adopts a tetrahedral shape.



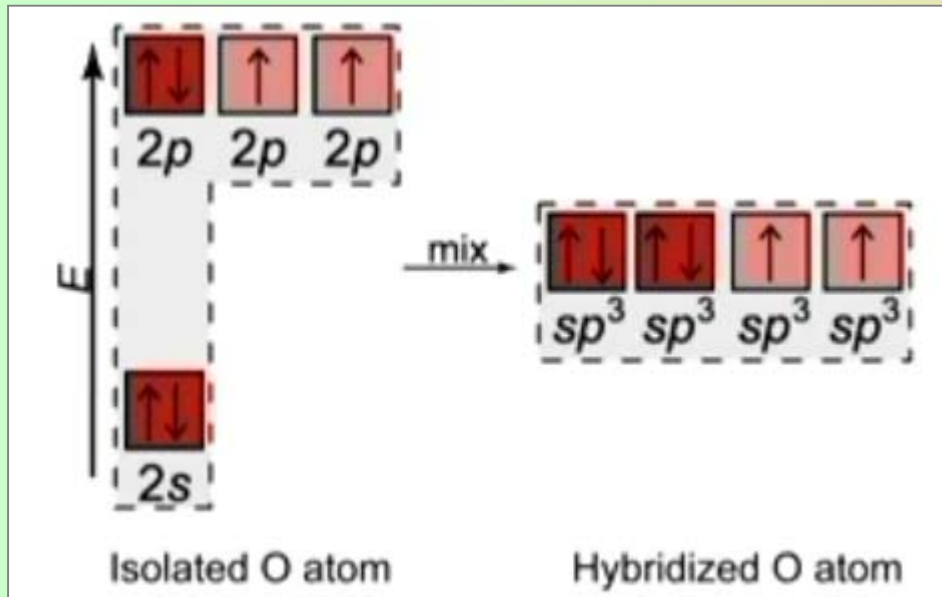
Hybridization



When nitrogen hybridizes, forming four sp^3 orbitals, one of those orbitals is filled with the lone pair and the rest with single bonding electrons.



Hybridization



When oxygen hybridizes, forming four sp^3 orbitals, two orbitals are filled with lone pairs and the rest with single bonding electrons.

