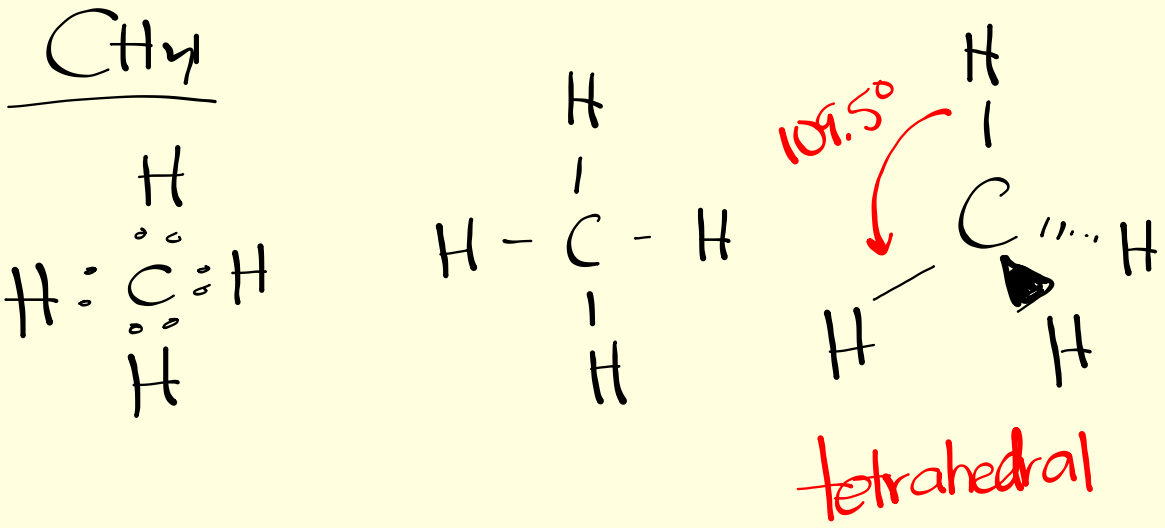
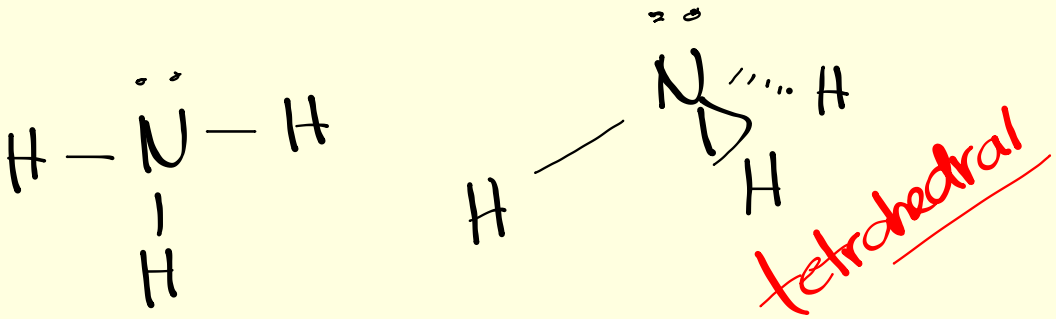
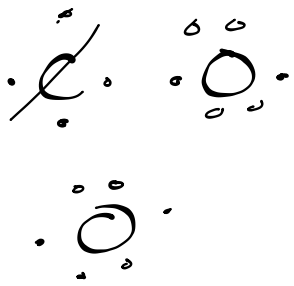
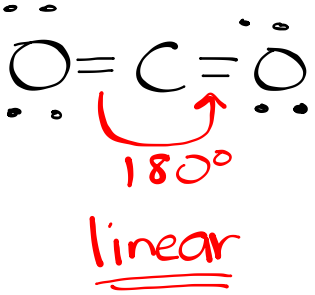
VSEPR





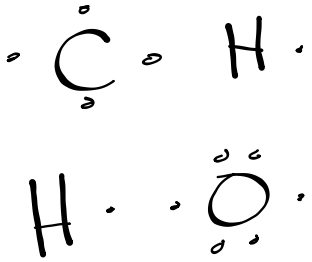
Ex. CO_2

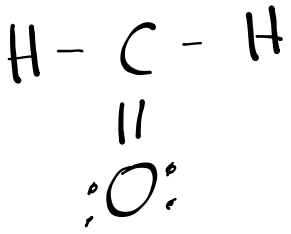


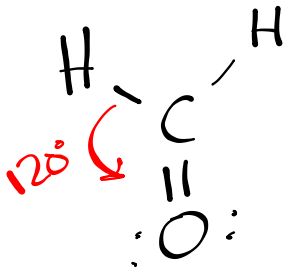


When predicting molecular shapes, double and triple bonds are treated as single bonds.

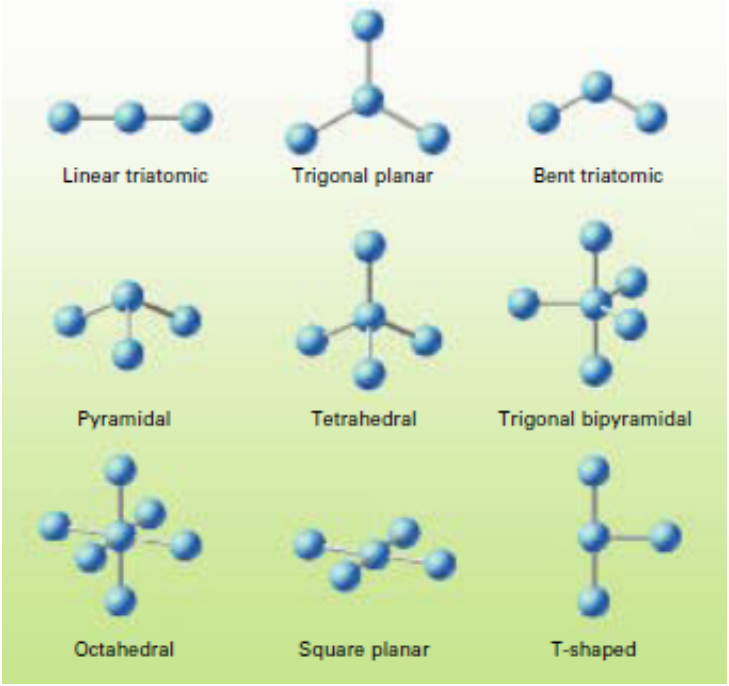
Ex. CH_2O







trigonal planar

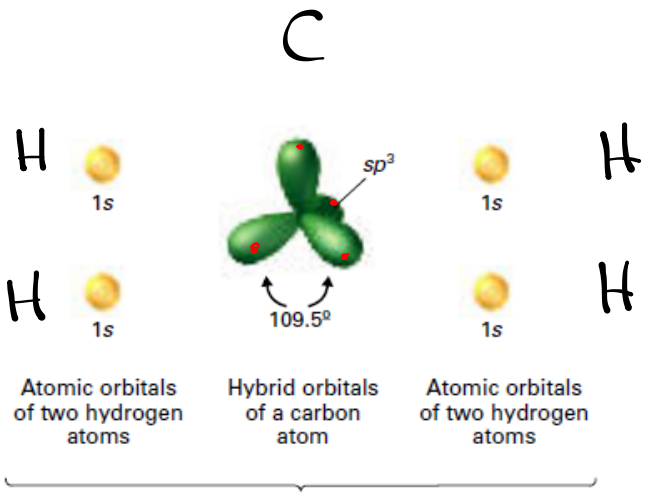

Linear triatomic
Trigonal planar
Bent triatomic
Pyramidal
Tetrahedral
Trigonal bipyramidal
Octahedral
Square planar
T-shaped

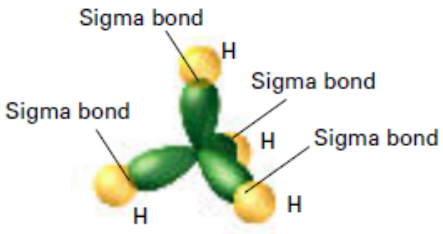
Hybridization Involving Single Bonds

In **hybridization**, atomic orbitals mix to form the same total number of equivalent hybrid orbitals.

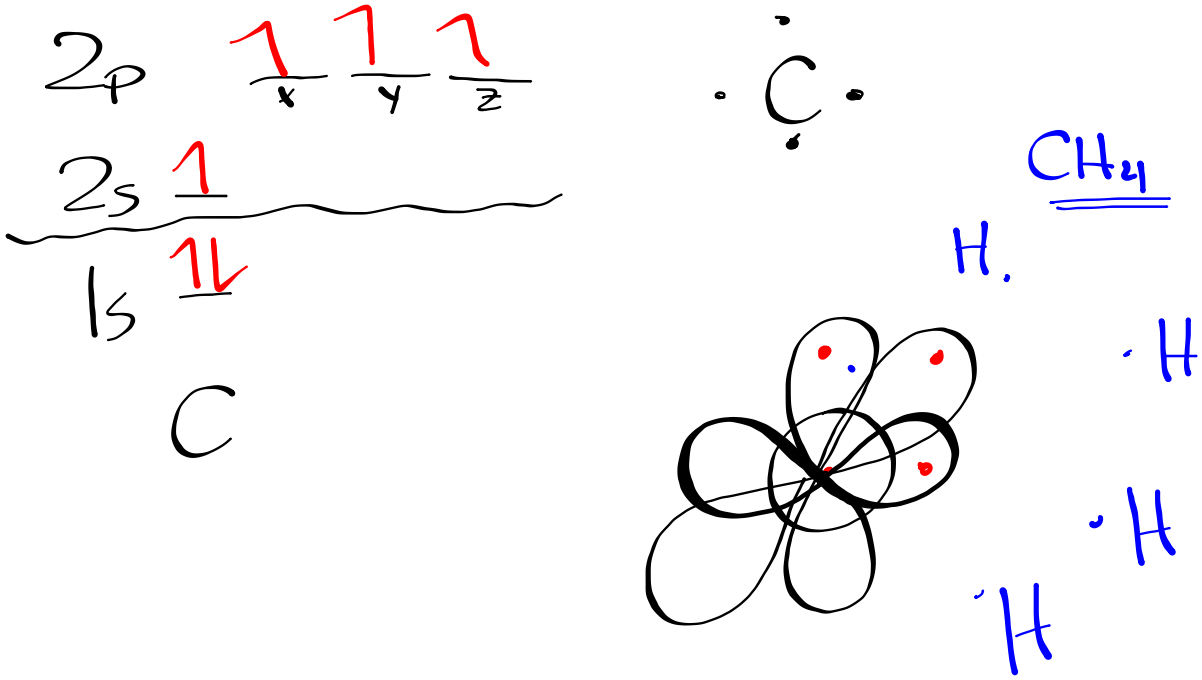
Ex. CH_4

The one *2s* orbital and three *2p* orbitals of a carbon atom mix to form four sp^3 hybrid orbitals.





Methane molecule


2p
x y z
2s
1s
C
·C·
CH4
H.
·H
·H
H

Atomic Orbitals

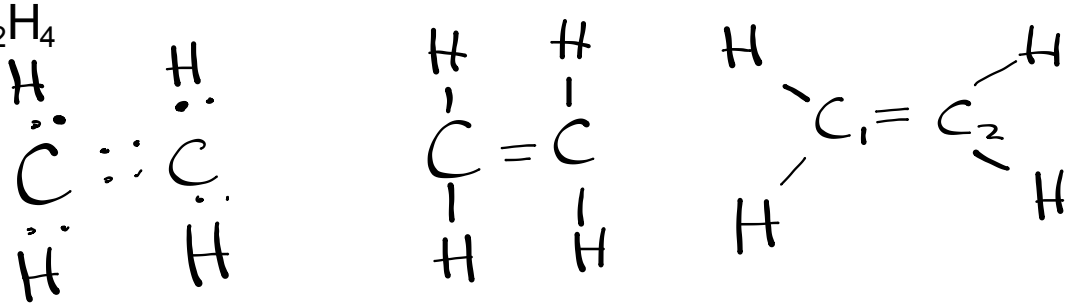
Molecular Orbitals

$$S + p_x + p_y + p_z \rightarrow sp^3 + sp^3 + sp^3 + sp^3$$

$4\,e^-$

Hybridization Involving Double Bonds

Ex. C_2H_4

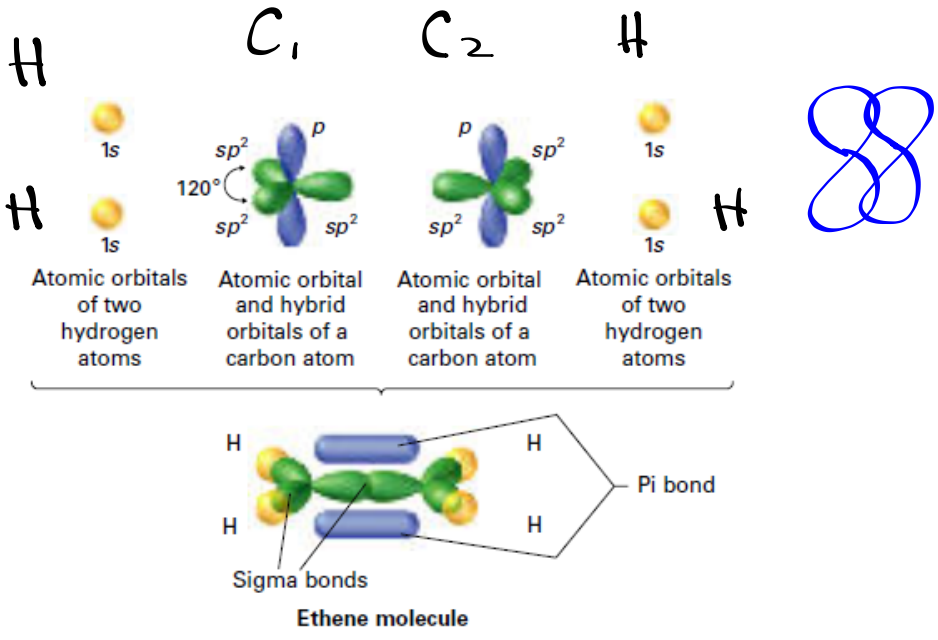


The one *2s* orbital and two *2p* orbitals of each carbon atom mix to form three sp^2 hybrid orbitals.

Two of the sp^2 orbitals overlap with the *1s* hydrogen orbital to form carbon-hydrogen sigma bonds.

The third sp^2 orbital overlaps with an sp^2 orbital from the other carbon to form a carbon-carbon sigma bond.

The non-bonding *2p* orbitals overlap side-by-side to form a carbon-carbon pi bond.



Atomic Orbitals

Molecular Orbitals

$S + p_x + p_z \longrightarrow \underbrace{sp^2 + sp^2 + sp^2}_{3\sigma}$

p_y

p_y

$\downarrow$

π