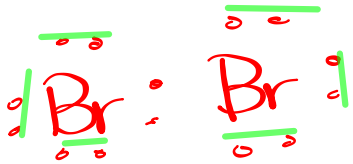
Worksheet 8.2

H_2O

Br_2

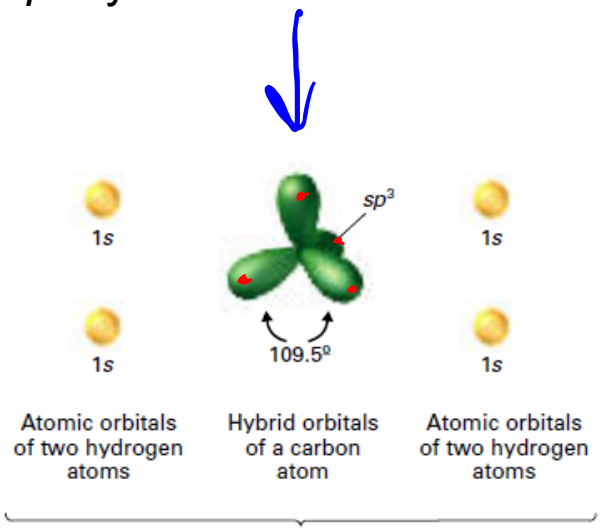


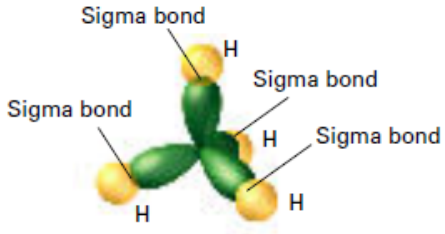
Hybridization Involving Single Bonds

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

Ex. CH_4

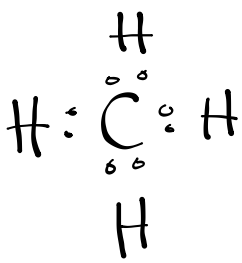
The one *2s* orbital and three *2p* orbitals of a carbon atom mix to form four sp^3 hybrid orbitals.

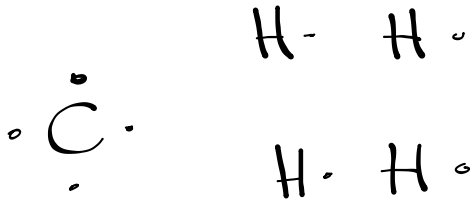




Methane molecule

CH_4





$2p\ \uparrow\ \uparrow\ \uparrow$

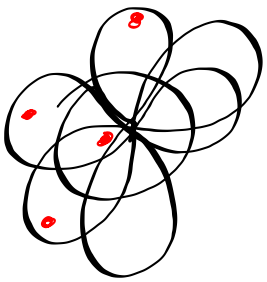
$2s\ \uparrow$

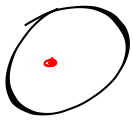
$1s\ \uparrow\downarrow$

C (6)

$1s\ \uparrow$

H (1)





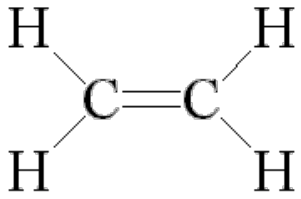
* C bonding to 4 atoms

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

4 σ bonds

Hybridization Involving Double Bonds

Ex. C_2H_4

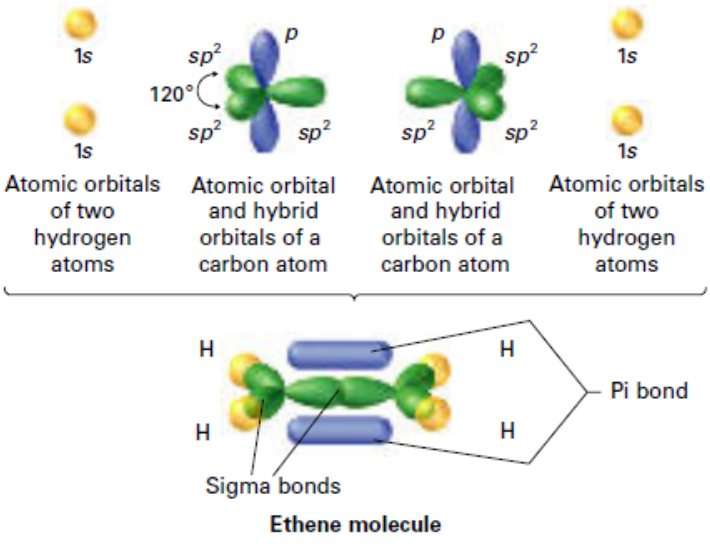


The one *2s* orbital and two *2p* orbitals of each carbon atom mix to form three sp^2 hybrid orbitals.

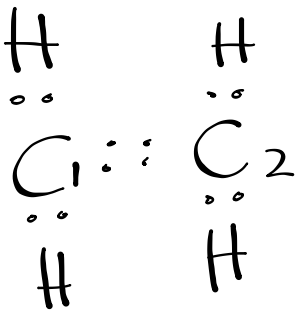
Two of the sp^2 orbitals overlap with the *1s* hydrogen orbital to form carbon-hydrogen sigma bonds.

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.



C_2H_4



C_1 → bonds to 3 atoms

$S + P_x + P_z \rightarrow sp^2 + sp^2 + sp^2$

3σ bonds

P_y → π bond

(leftover)

Hybridization Involving Triple Bonds

C_1 → bonds to 2 atoms

Ex. C_2H_2

$S + P_z \rightarrow Sp + Sp$

2 σ bonds

$P_x, P_y \rightarrow 2\ \pi$ bonds

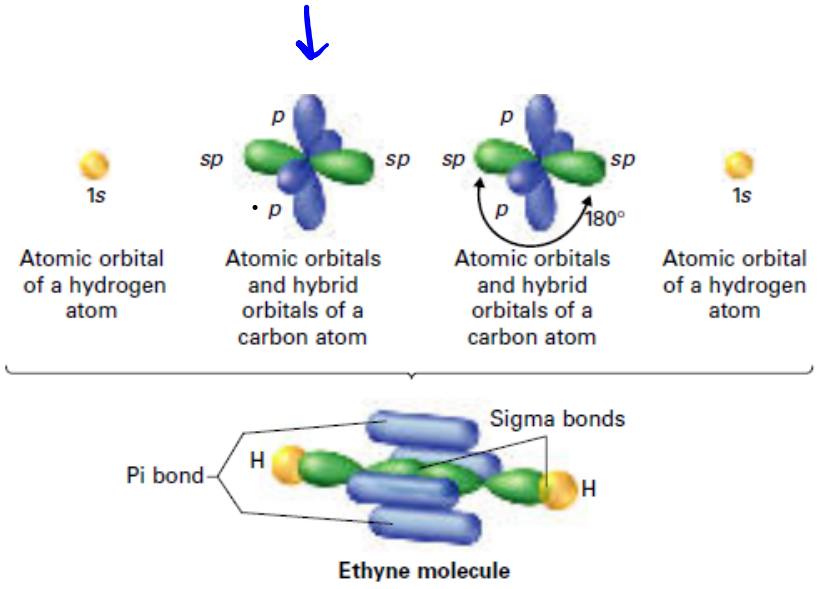
H : C_1 : : : C_2 : H

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

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

The second *sp* orbital overlaps with the *sp* orbital from the other carbon to form a carbon-carbon sigma bond.

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



Homework

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