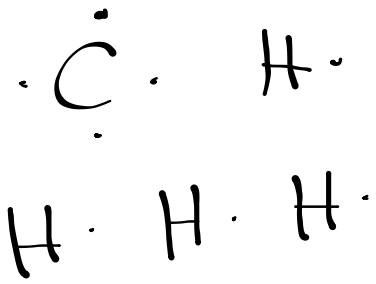
CH_4



2p 1 1 1

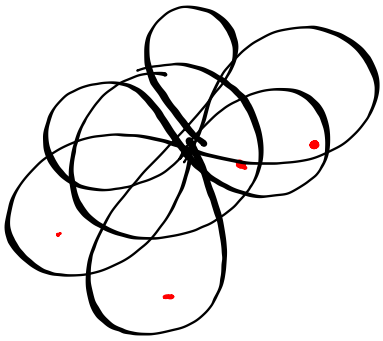
2s 1

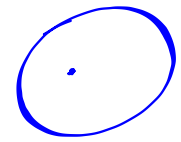
1s 1

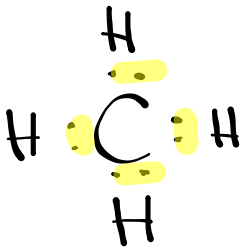
C

1s 1

H







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

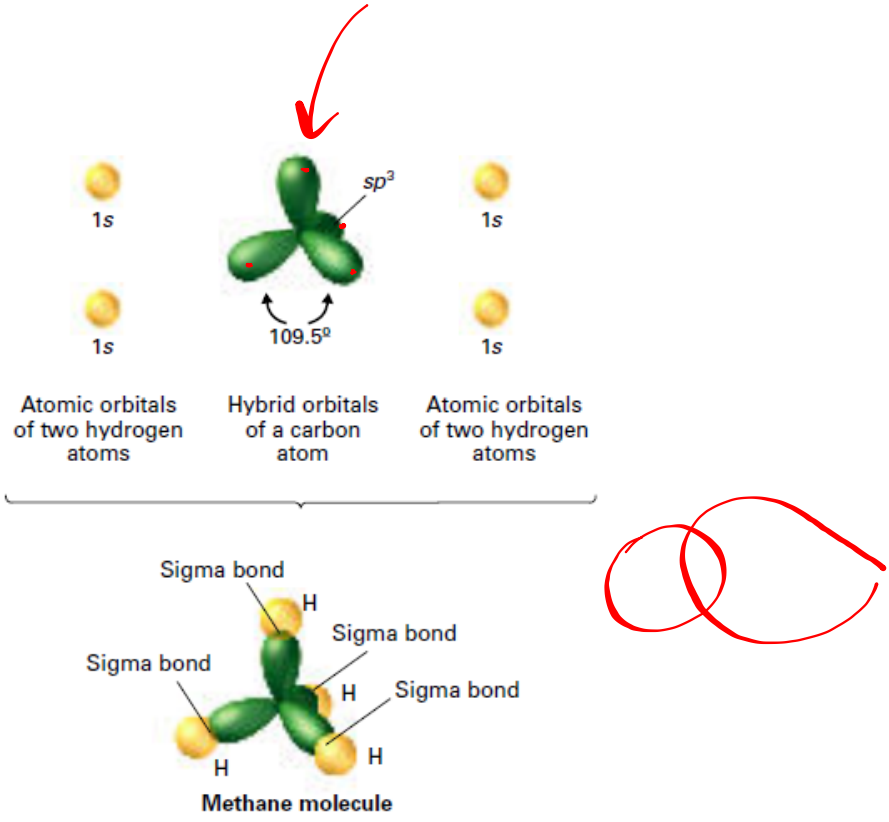
4σ

Hybridization Involving Single Bonds

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

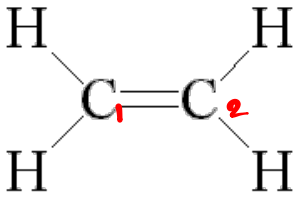
Ex. CH_4

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



Hybridization Involving Double Bonds

Ex. C_2H_4

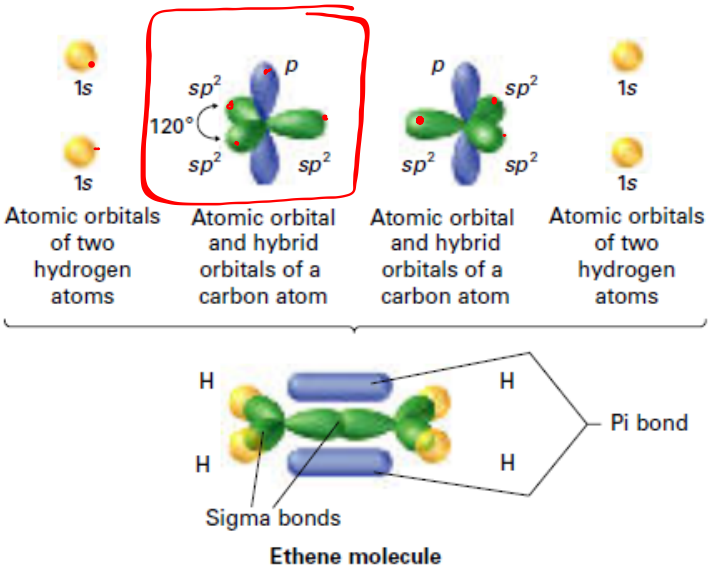


The one *2s* orbital and two *2p* orbitals of each carbon atom mix to form three sp^2 hybrid orbitals.

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.



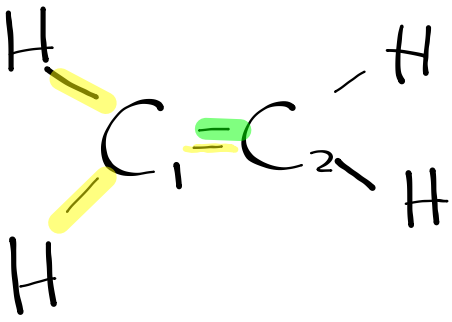
$S + p_x + p_z \longrightarrow sp^2 + sp^2 + sp^2$

3σ

p_y p_y (leftover)

$\downarrow$

π



C_2

$S + p_x + p_z \rightarrow sp^2 + sp^2 + sp^2$

p_y

Hybridization Involving Triple Bonds

Ex. C_2H_2

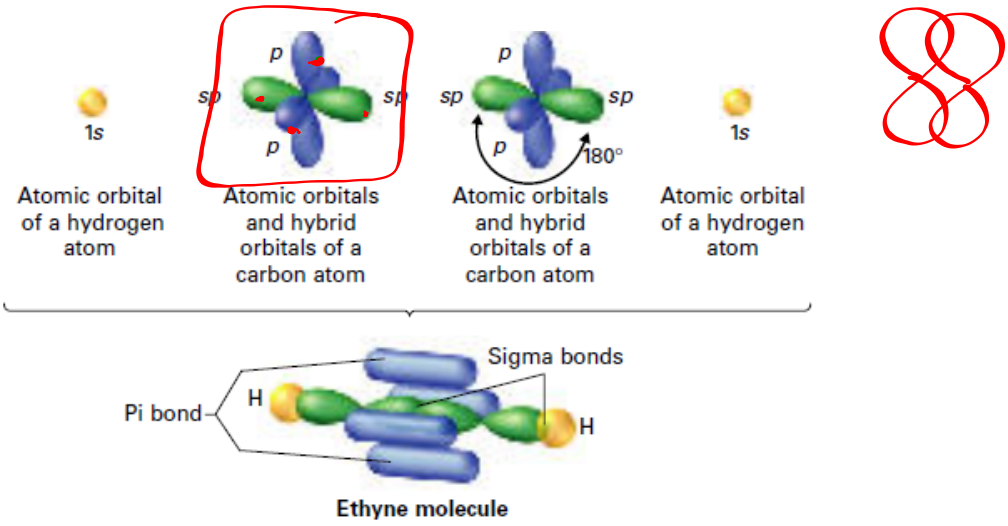
$$H—C\equiv C—H$$

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

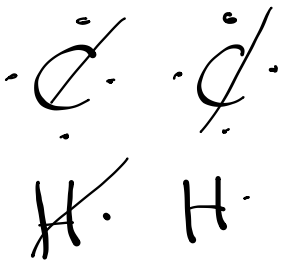
One of the *sp* orbitals overlap with the *1s* hydrogen orbital to form carbon-hydrogen sigma bonds.

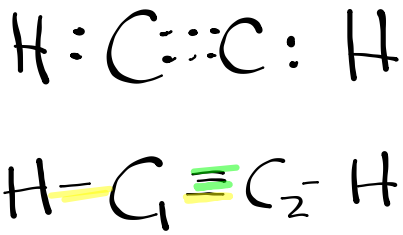
The second *sp* orbital overlaps with the *sp* orbital from the other carbon to form a carbon-carbon sigma bond.

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



C_2H_2





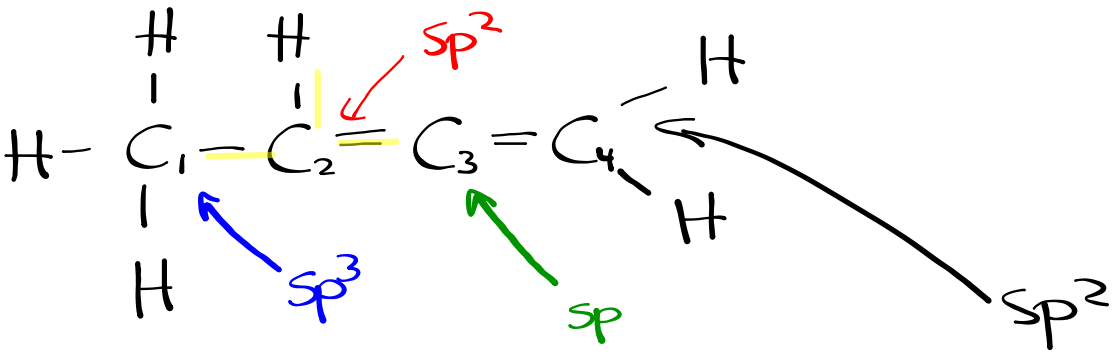
$s + p_x \longrightarrow sp + sp$

2σ

p_y, p_z

2π

Determine the type of hybrid orbitals used for each of the following carbons atoms.



C_1: $S + p_x + p_y + p_z \rightarrow sp^3 + sp^3 + sp^3 + sp^3$

C_2: $S + p_y + p_z \rightarrow sp^2 + sp^2 + sp^2$

C_3: $S + p_y \rightarrow sp + sp$

C_4: $S + p_x + p_y \rightarrow sp^2 + sp^2 + sp^2$

Homework

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Worksheet