(6) **Today**

Sections 1.5-1.10
Valence Bond Theory

Next Class (7)

Sections 1.12
Drawing Chemical Structures

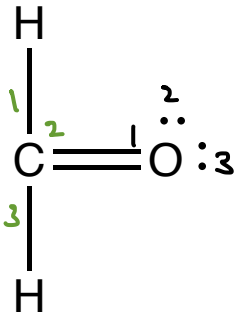
(8) **Second Class from Today**

Sections 1.12
Drawing Chemical Structures

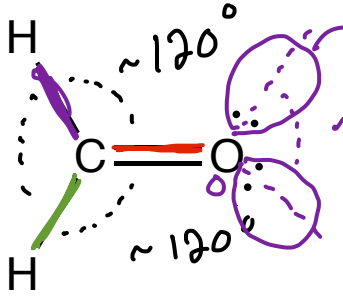
Sections 2.1 - 2.4
Polar Covalent Bonds, Formal Charges,
Resonance/Electron Delocalization

Third Class from Today (9)

Sections 2.4 – 2.6
Resonance/Electron Delocalizatrion



Apply VSEPR rules



lone-pair e⁻ are in sp² hybrids

C we need 3 HO's to point in 3 different directions

mix 3 AO's to make 3 HO's

AO's 2s × 2p_x × 2p_y unhybridized 2p_z

⇓ hybridize

HO's sp² sp² sp² — overlap with sp² on O to make a bond

make a bond to H by overlapping with H's 1s

make a bond to other H by overlapping with 1s

O we need 3 HO's to point in 3 different directions

mix 3 AO's to make 3 HO's

AO 2s × 2p_x 2p_y 2p_z

⇓

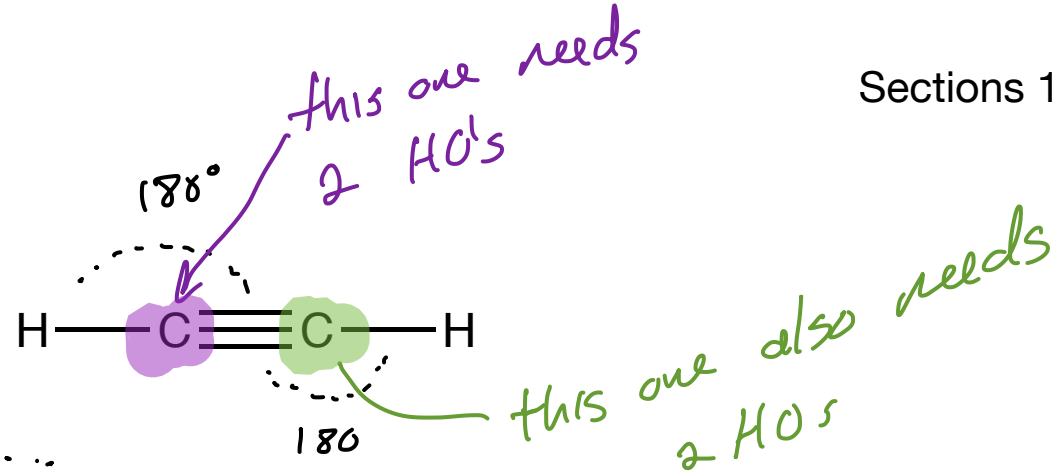
sp² sp² sp² 2p_z unhybridized

3 bonds to C from hybrids

4th bond made using 2p_z from C & 2p_z from O

https://www.westfield.ma.edu/PersonalPages/cmasi/organic/hybrid/hybrid2.html

Identify atoms that use sp² hybrid orbitals to form bonds and hold lone-pair electrons



VSEPR says 2 directions...

Two HO's

2s × 2px

2s × 2px

sp sp 2py 2pz

sp sp 2py 2pz

each carbon has 2 sp hybrids to make σ bonds

2py overlaps with 2py to form a π bond

H's 1s overlaps with an sp

2pz overlaps with 2pz to form another π bond

C's sp overlaps with C's sp

https://www.westfield.ma.edu/PersonalPages/cmasi/organic/hybrid/hybrid2.html

Identify atoms that use sp hybrid orbitals to form bonds and hold lone-pair electrons

The methyl cation, anion, and radical

Sections 1.5 - 1.10

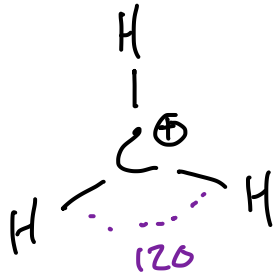
Determine the hybridization of unusual molecular fragments

CH_3^+

Ve⁻'s

C 3e⁻

3 H 3e⁻



3 directions ... 3 AO's

3 AO's mixed

2s × 2p_x × 2p_y

⇓

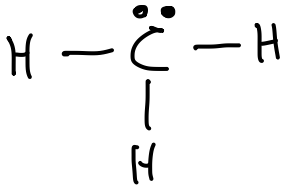
sp^2 sp^2 sp^2 unhybridized $2p_z$ is empty

CH_3^-

Ve⁻'s

C 5e⁻

3H 3e⁻



4 directions

4 AO's mixed

2s × 2p_x × 2p_y × 2p_z

⇓

sp^3 sp^3 sp^3 sp^3

One sp^3 holds lone pair

$CH_3^\bullet$

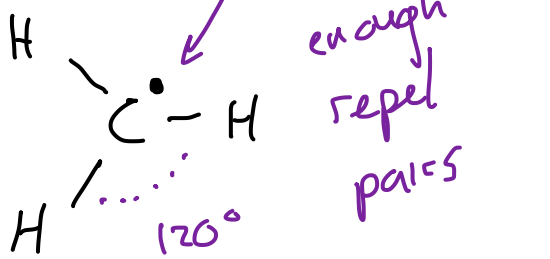
C 4e⁻

3 H 3e⁻

radical

↓

odd # of e⁻



3 directions

3 AO's mixed

2s × 2p_x × 2p_y

⇓

sp^2 sp^2 sp^2 unhybridized $2p_z$ holds 1 e⁻

hybrid orbitals are used to form σ bonds and to hold lone-pair electrons

single bonds are always σ bonds

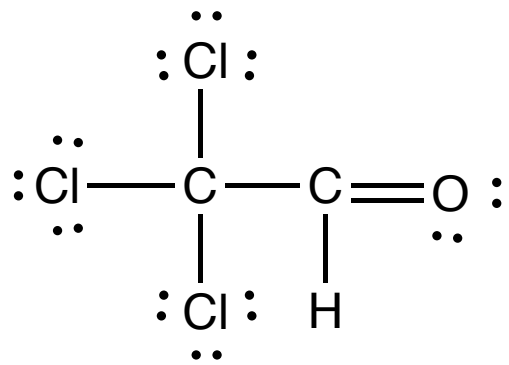
double and triple bonds are formed from σ bonds and π bonds

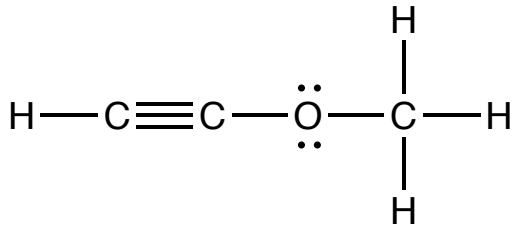
# of σ bonds + pairs of lone-pair electrons = # of hybrid orbitals needed

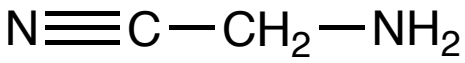
count out the # of atomic orbitals need to make the hybrid orbitals
starting with the 2s orbital (or 3s if appropriate)

name the hybrid orbitals sp^n where n is the number of p orbitals used

Practice

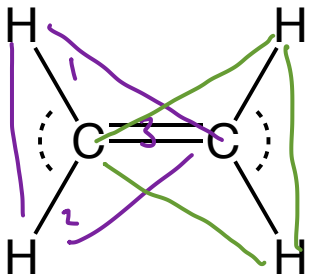




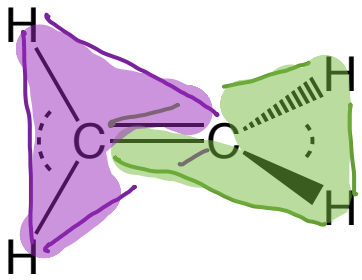


Some consequences of hybridization: Which one... both satisfy VSEPR rules

VSEPR



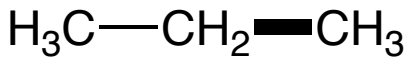
coplanar triangles



intersecting triangles

Which bond is stronger?

?



Explain observations and make predictions based on the hybridization of an atom