(5) **Today**

Sections 1.5-1.10
Valence Bond Theory

Skipping Section 1.11 for now
An introduction to Molecular Orbital Theory

Sections 1.12
Drawing Chemical Structures

Next Class (6)

Sections 1.12
Drawing Chemical Structures

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

(7) **Second Class from Today**

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

Sections 2.4 – 2.6
Resonance/Electron Delocalization

Third Class from Today (8)

Sections 2.4 – 2.6
Resonance/Electron Delocalization

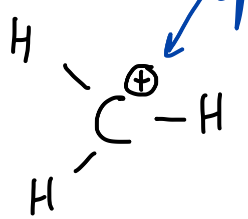
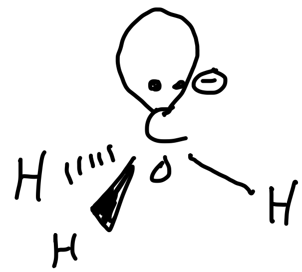
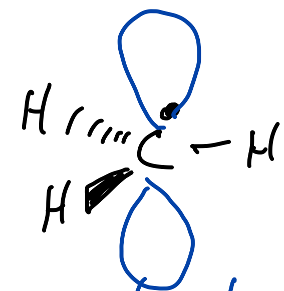
Sections 2.7 – 2.11
Acids and Bases

The methyl cation, anion, and radical

radical

• means add # of e⁻'s

C 4 ve⁻'s + 3 ve⁻'s − e⁻ = 6 e⁻'s or 3 pairs

CH_3^+	CH_3^-	$CH_3^\bullet$
		

sp2 hybridized

sp3 hybridized

steric # = 3 VSEPR

3 σ bonds ... 3 HO's needed to make this trigonal planar shape

mix 3 AO's to make 3 HO's

2s, 2px, 2py => sp², sp², sp²

an empty 2pz orbital

4 HO's needed

2s, 2px, 2py, 2pz
⇓
sp³, sp³, sp³, sp³

trigonal planar

need 3 HO's to point in 3 directions

mix 3 AO's ...

2s, 2px, 2py => sp², sp², sp²

the 2pz orbital has 1 e⁻

Determine the hybridization of unusual molecular fragments

- hybrid orbitals are used to form σ bonds and to hold lone-pair electrons
- in the valence bond model, single bonds are always σ bonds
- double and triple bonds are formed from σ bonds plus π bonds

σ + π σ + π + π

How to determine hybridization:

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

or

# of hybrid orbitals needed = # number of directions electrons must be pointed in

valence orbitals

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: Determine the Hybridization of the Atoms in the Following Molecules

of HO's Needed

  # σ bonds + # pairs of lone-pair e⁻'s

count out # of AO's needed

  2s x 2p x etc

name the hybrids

  sp^3 made from one s and three p orbitals

  sp^2 made from one s and two p orbitals

  sp made from one s and one p orbital

C… VSEPR … # of directions

σ + lp e⁻

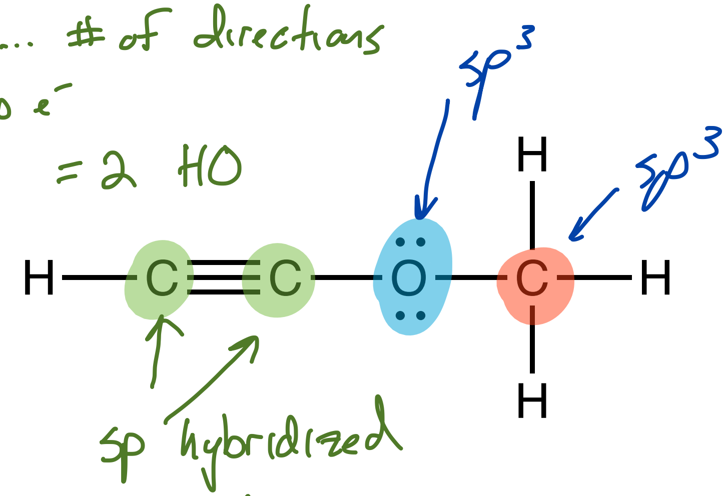
2 0 = 2 HO

Make 2 HO's from 2 AO's

2s, $2p_x$ ⟹ sp, sp

$2p_y$ overlaps with $2p_y$ = π bond

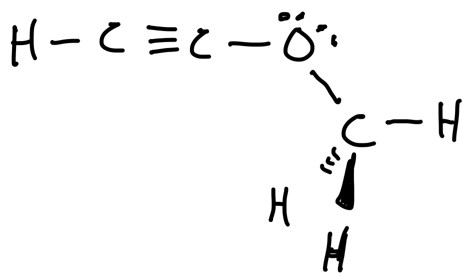
$2p_z$ overlaps with $2p_z$ = π bond



O 2σ + 2 sets of lp e⁻'s

4 HO's needed, 4 AO's must be hybridized

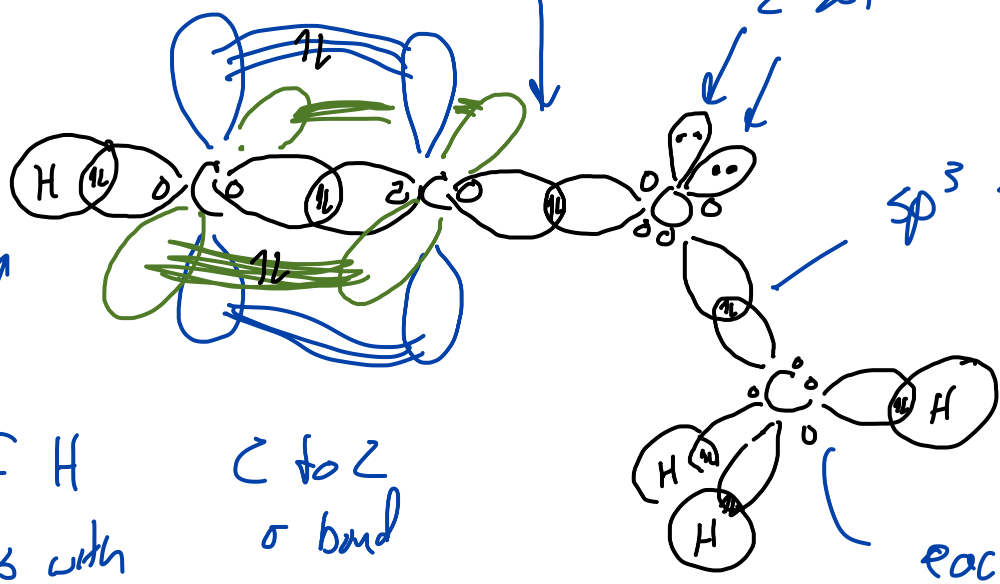
2s, $2p_x$, $2p_y$, $2p_z$ ⟹ sp^3, sp^3, sp^3, sp^3



sp on C overlaps with sp^3 on O

2 sets of lp e^-'s in sp^3 hybrids

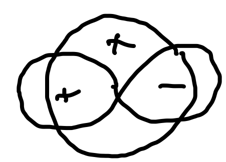
sp^3 from O overlaps with sp^3 from C



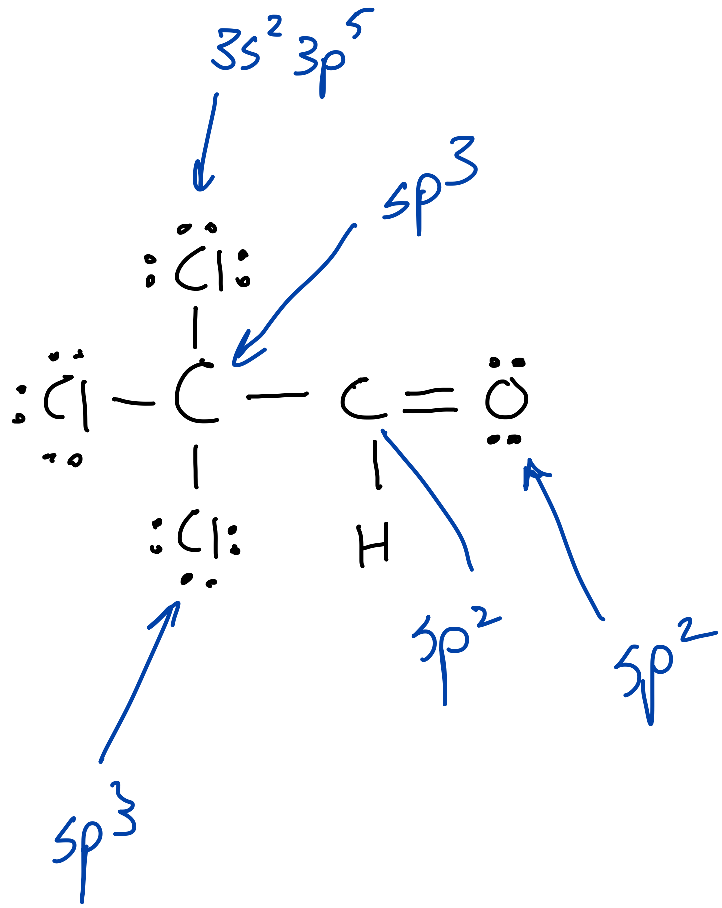
1s of H overlaps with sp of C to make a σ bond

C to C σ bond made from overlapping sp hybrids

each C to H bonds is made by overlapping sp^3 on C with a 1s on H



C $2s^2 2p^2$



\# of HOs needed?

use the valence orbitals → # of AOs to mix?

name of the HOs?