(6) **Today**

Sections 1.5-1.10
Valence Bond Theory

Sections 1.12
Drawing Chemical Structures

Next Class (7)

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

Sections 2.4 – 2.6
Resonance/Electron Delocalization

(8) **Second Class from Today**

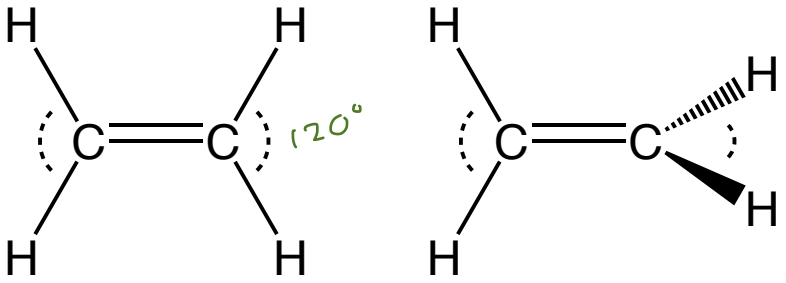
Sections 2.4 – 2.6
Resonance/Electron Delocalization

Sections 2.7 – 2.11
Acids and Bases

Third Class from Today (9)

Sections 2.7 – 2.11
Acids and Bases

What can we use Valance Bond Theory for?

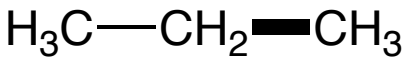


Which one? Both C atoms are trigonal planar

Why is there free rotation around C to C single bonds but not C to C double bonds?

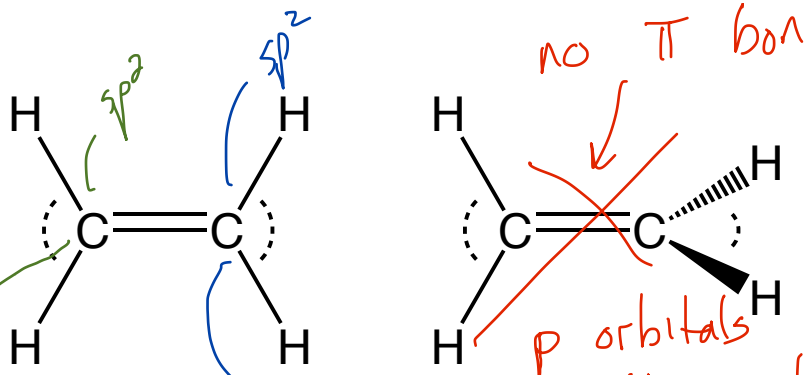
Which bond is stronger?

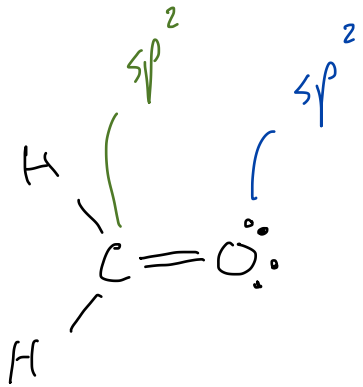
?



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

What can we use Valance Bond Theory for?





Which one? Both C atoms are trigonal planar

one unhybridized p orbital left

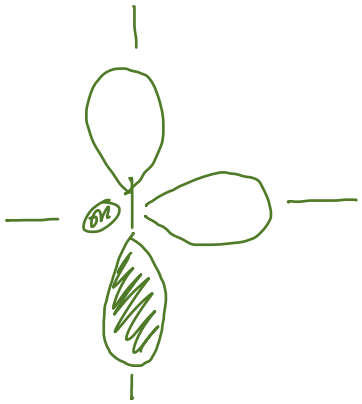
one unhybridized p orbital left

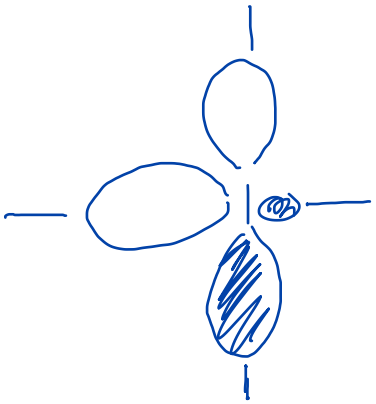
The first bond in the double bond is made from an sp^2 overlapping with an sp^2 on 2nd atom... share e⁻... make a bond (σ bond)

The second bond is a π bond. One unhybridized p orbital overlaps with the unhybridized p orbital on the second atom... share e⁻... bond

The p orbitals must be ∥, and the sp^2 hybrids are ⊥ to the unhybridized p orbitals ∴ (sophmore geometry)... the hybrids must be in the same plane... coplanar

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





because p orbitals are ⊥ to each other

sp^2 hybrid is ⊥ to unhybridized p orbital

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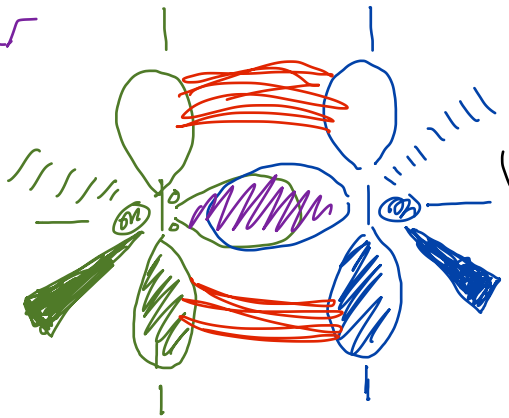
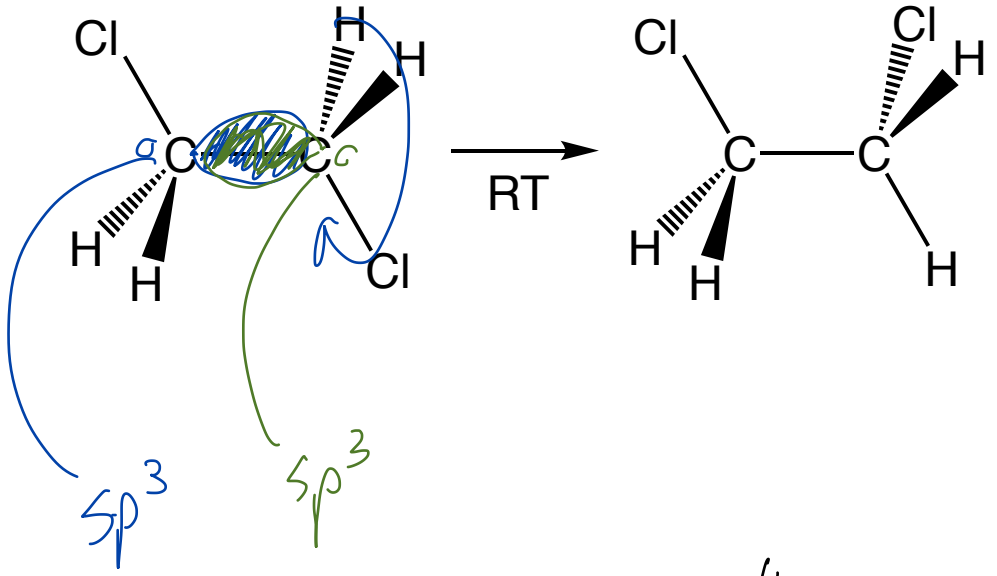
to form the π bond p and p must be parallel

two objects that are ⊥ to two parallel lines must be coplanar

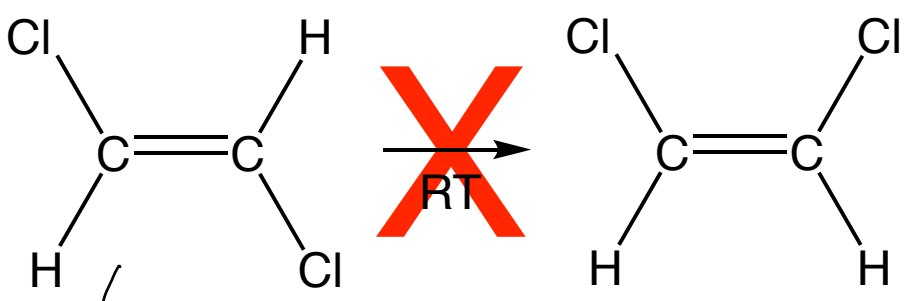


What can we use Valance Bond Theory for?

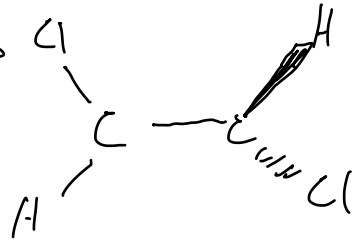
Why is there free rotation around C to C single bonds but not C to C double bonds?



rotation doesn't change the alignment of the overlapping hybrid orbitals forming the C to C bond



free rotation does not occur because of the db... the π bond



during the rotation the p orbitals would not be parallel!

to rotate around a db the π bond would have to break

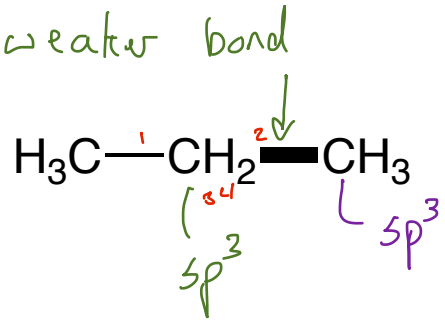
not enough E at RT to break π bond

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

What can we use Valance Bond Theory for?

Which bond is strongest? BDE

370 kJ/mol[2], 355±8 kJ/mol[3]



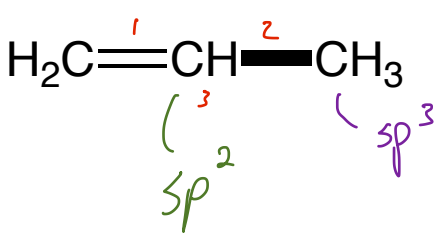
1 s mixed with 3 p's ...

4 parts total

$\frac{1}{4}$ s or

25 % s 75 % p

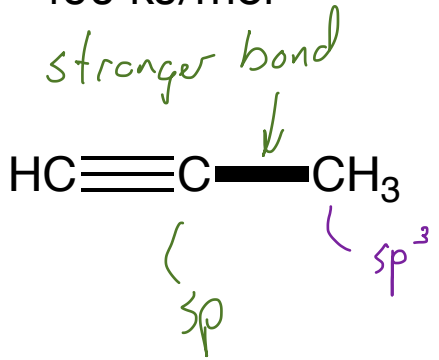
426 kJ/mol[1]



1 part s 2 parts p

33 % s 67 % p

490 kJ/mol[4]



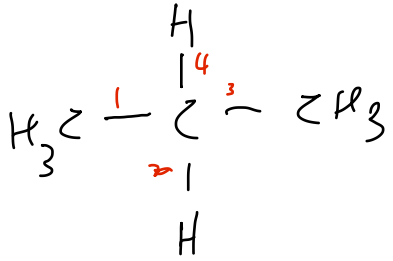
1 part s 1 part p

50 % s 50 % p

s character is increasing from left to right

e⁻'s not as close to nucleus

e⁻'s get closer to nucleus and are more strongly attracted therefore a stronger bond



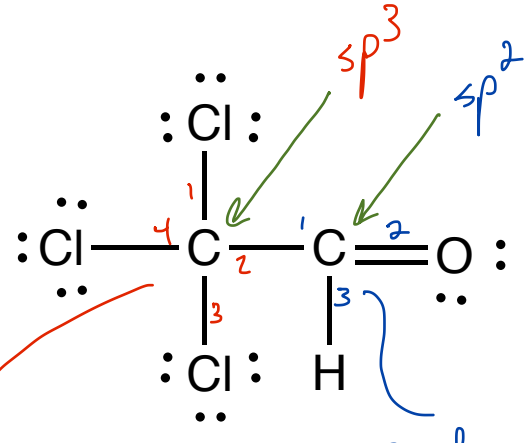
[2] Organic Chemistry, 10th ed. McMurry.

[3] Chem. Rev. **66**, 465 (1966).

[4] J.Chem.Ed. **42**, 502 (1965)

# of directions = # of HO's needed = # of AO's mixed

Practice

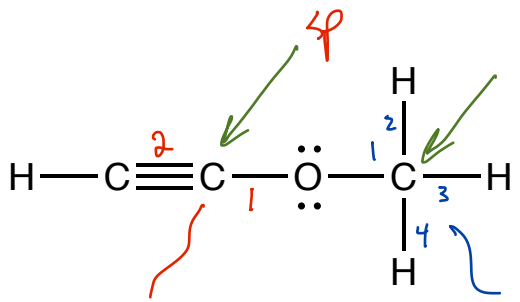


4 directions

2s, 2px, 2py, 2pz => hybridize

3 directions

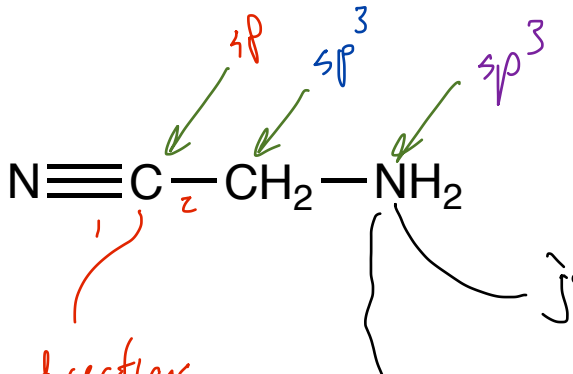
2s, 2px, 2py => hybridize



2 directions

4 directions

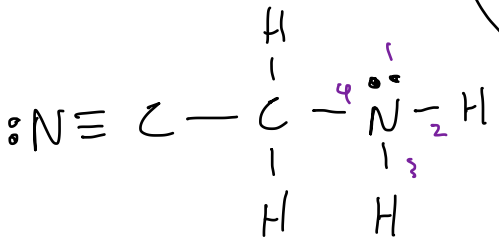
sp^3



2 directions

just because we didn't draw the bonds from N to H doesn't mean they're not there

just because we didn't draw the lp e-'s doesn't mean they're not there



H – H