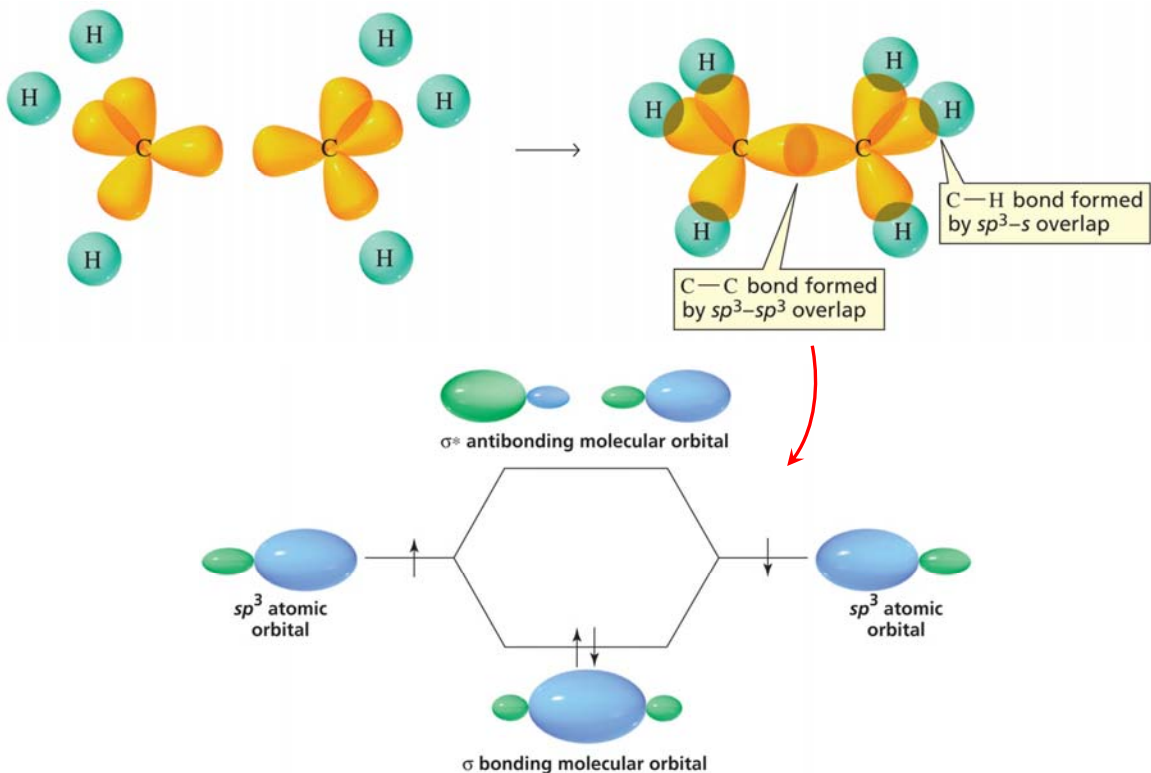
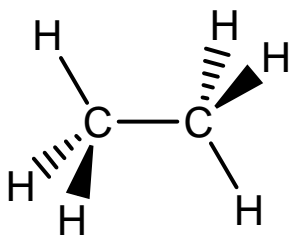


sp^3 Hybridization in Ethane (CH_3CH_3)

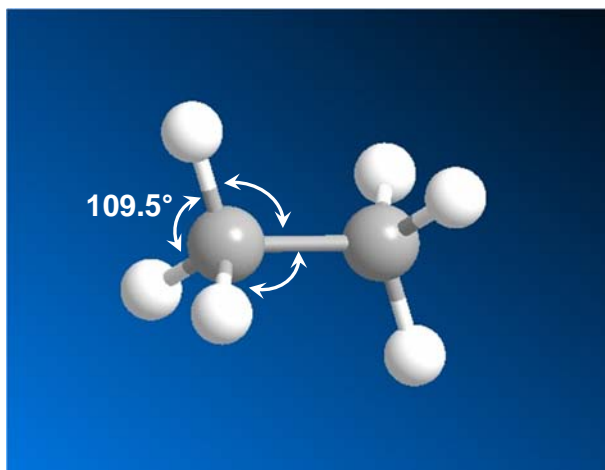


Geometry of Ethane (CH_3CH_3)

So, ethane is tetrahedral at both carbons.



**All bond angles
 109.5°**

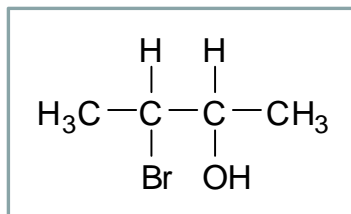
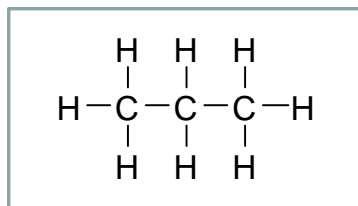


From ChemBio3D, free to UofM students;
<http://tinyurl.com/2301Office>.

True for more complicated molecules too.

Wedge/Dash-Bond Drawings

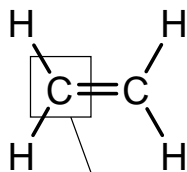
How might you draw 3-D perspective for:



Three isomers of difluoropropane (C₃H₆F₂)

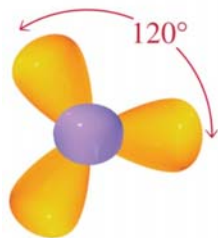
Draw all bonds and atoms.

Geometry of Ethene (CH₂CH₂)

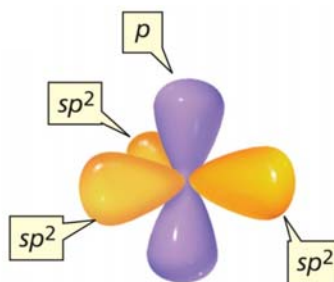


Each carbon has only 3 (σ) bonding partners;

So, carbons are $s+p+p = sp^2$ hybridized.



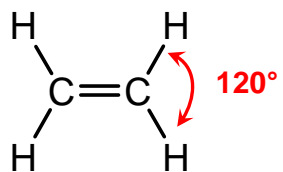
top view



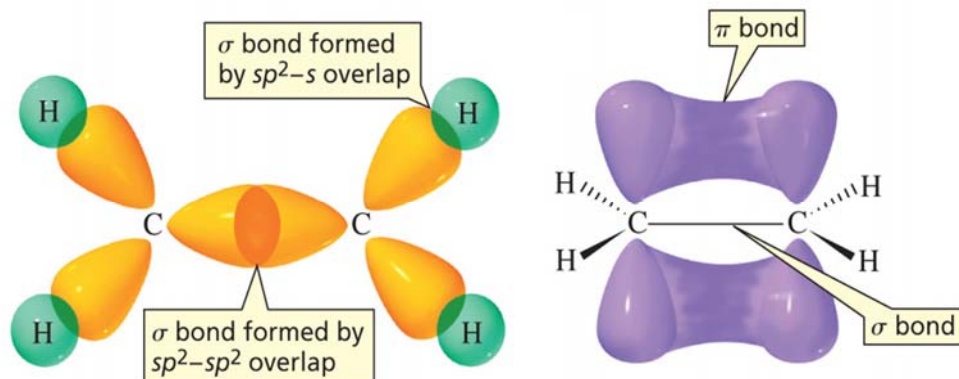
side view

Only σ -bonding hybrid orbitals determine geometry by VSEPR.

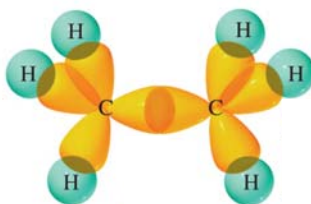
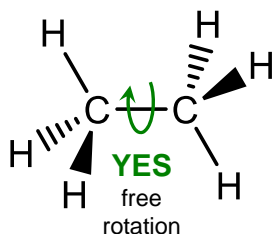
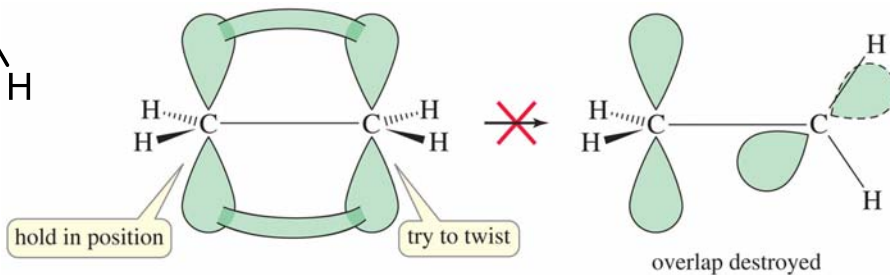
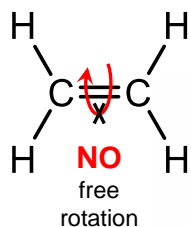
Geometry of Ethene (CH₂CH₂)



The two bonds of a double bond are not the same.



Free Rotation About Single Bonds, But Not Double Bonds



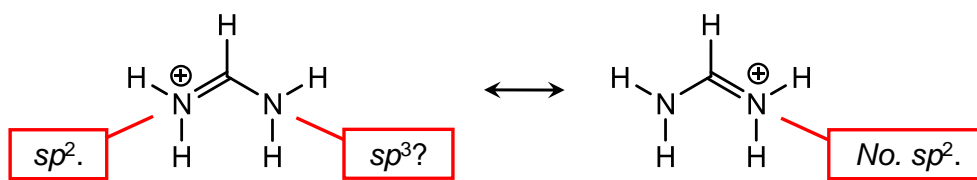
No orbital interactions that limit rotation.

Including Resonance in Geometry

What if a molecule can be described by multiple good (major) resonance structures?

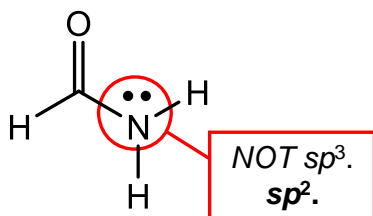
For each atom, the lowest hybridization state observed in major resonance structures is the correct one.

Example: What is hybridization on nitrogen atoms?

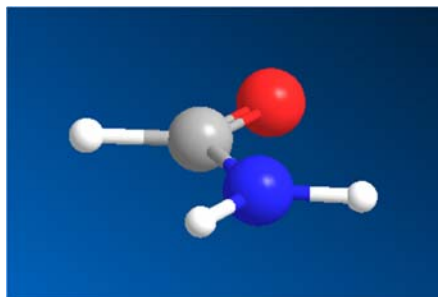


Answer: Both are sp^2 .

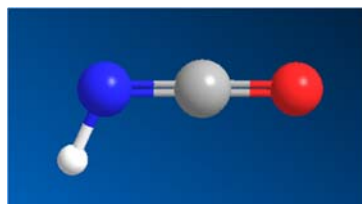
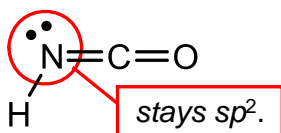
Nominally sp^3 -Hybridized Lone Pairs Adjacent to Multiple Bonds Switch to p



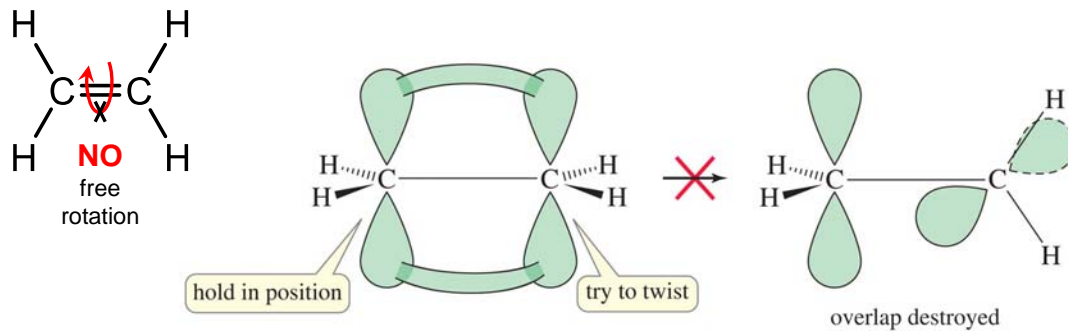
Lone pair occupies a p orbital, so it can mix with C-O π bond.



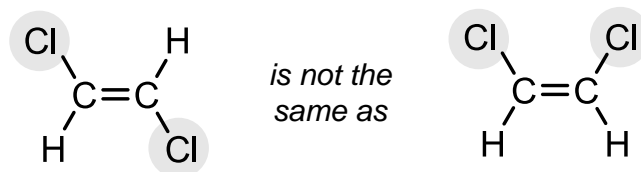
Oddly, this only works for nominally sp^3 atoms.



Just a Moment Ago...

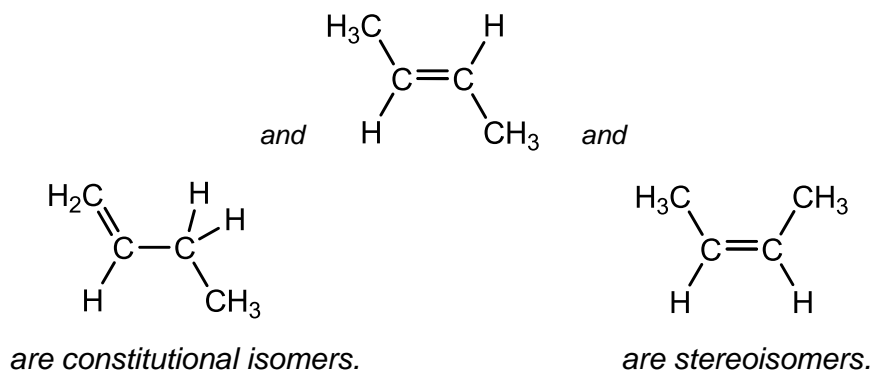
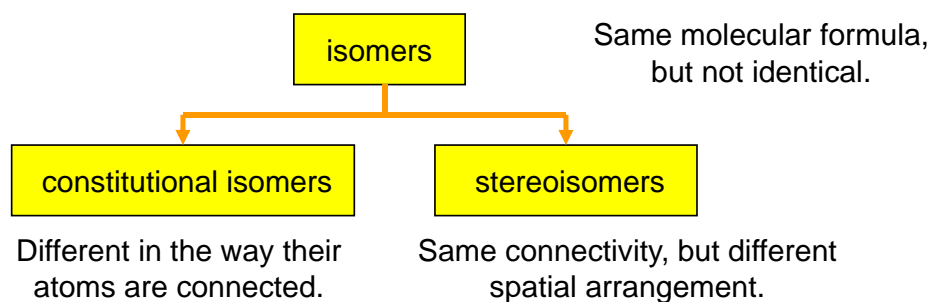


An important consequence:



even though they're connected the same.

Stereochemistry and Isomerism



Configurations and Conformations

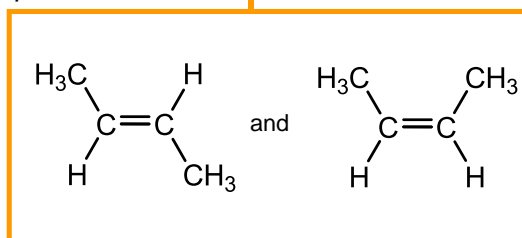
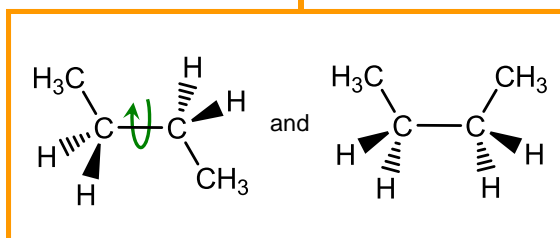
conformations
(e.g., rotation about
single bonds)

Interconvert rapidly at
room temperature;
cannot be separated

configurational isomers

Do not readily
interconvert;
can be isolated
separately

for example,



Electrons Drive Acid-Base Reactions

Lewis Base: An electron-pair donor.

Lewis Acid: An electron-pair acceptor.
(Here, also a proton donor.)

Organic chemists illustrate flow of electrons in reactions using curved arrows. (Sometimes called "electron pushing".)

