

4 different things attached to a central atom:

"things" = another atom or a lone pair

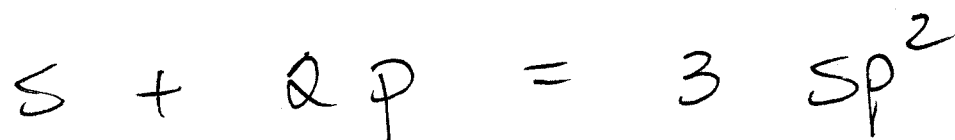
\* tetrahedral geometry ( $109.5^\circ$ )

\*  $sp^3$  hybridization

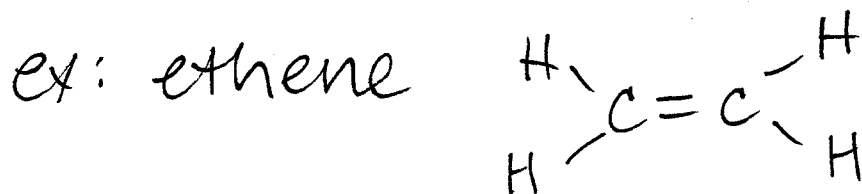
3 different things attached to a central atom:

\* VSEPR = trigonal planar ( $120^\circ$ )

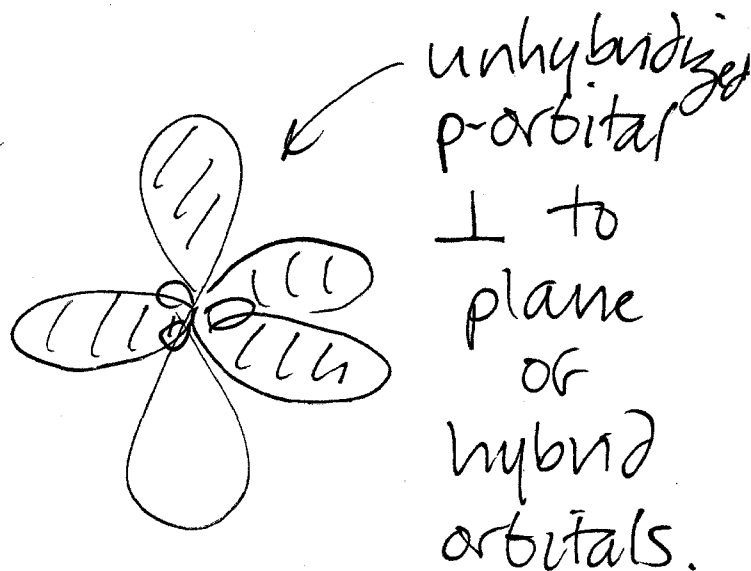
\*  $sp^2$  hybridization

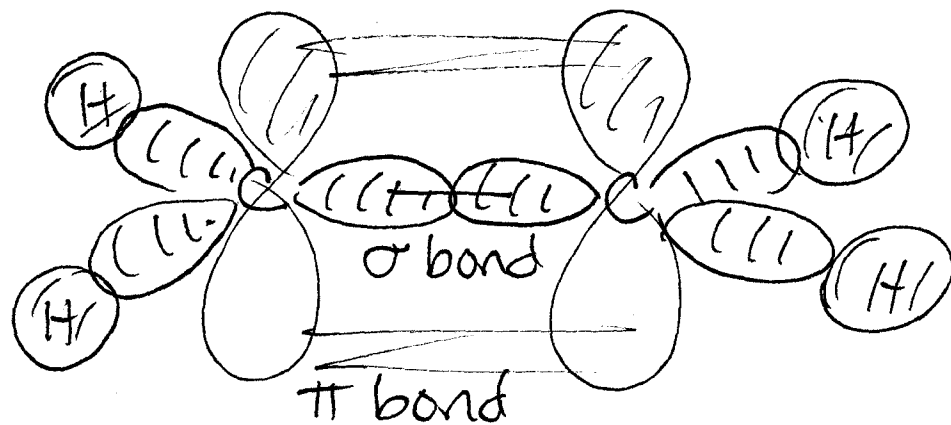


3 orbitals in a plane:



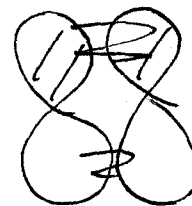
$sp^2$ :





$\pi$  bond -

side-to-side overlap  
between two p-orbs.



The  $\pi$  bond forces the molecule to be all in one plane - do not have free rotation about the C-C  $\sigma$  bond.

2 different things attached to a central atom.

\* VSEPR says linear ( $180^\circ$ )

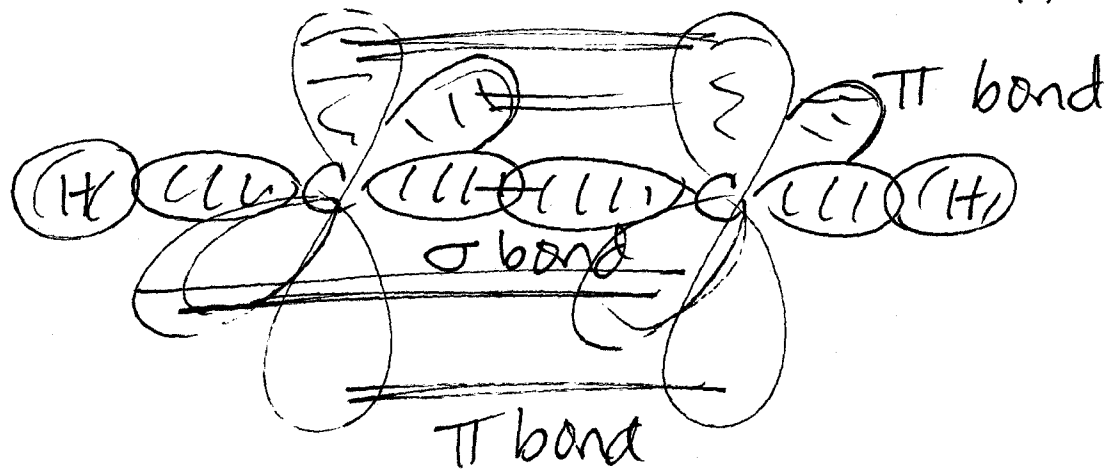
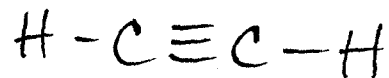
\* sp hybridized

$s + p = 2$  sp ~~( $1s$   $1p$ )~~

2 unhybridized p-orbitals left over -

$\perp$  to hybrid orbitals and to each other.

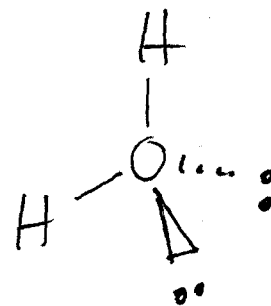
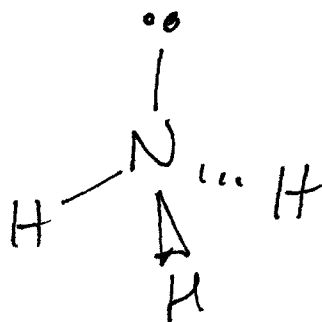
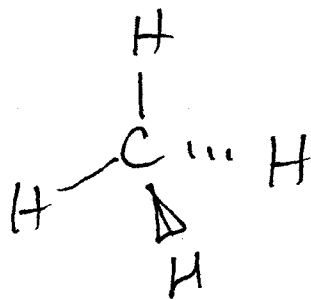
ex. acetylene



No free rotation -  
p-orbitals must  
be parallel to  
form the  $\pi$  bond.

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$sp^3$  tetrahedral  $\Rightarrow$  trig. pyramidal  $\Rightarrow$  bent  
 $sp^2$  trig. planar  $\Rightarrow$  bent  
 $sp$  linear

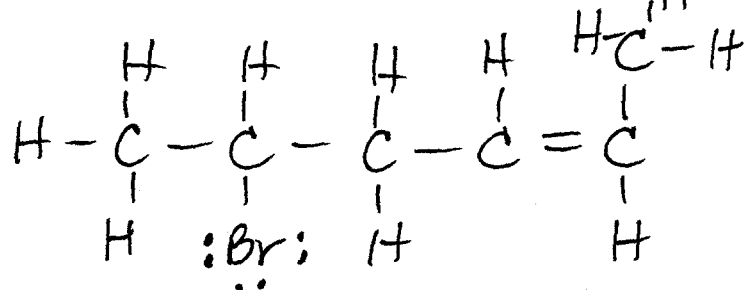


covalent bond lengths are very consistent.

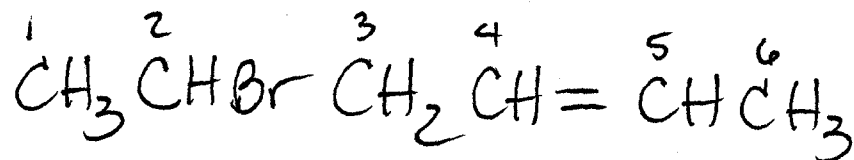
C-C	1.54 Å	longest	25% s char.
C=C	1.33 Å	↓	33% s char.
C≡C	1.20 Å	shortest	50% s char.

## Drawing Structures

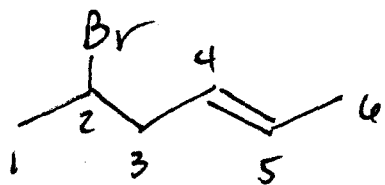
### 1. Lewis/modified Lewis



2. Condensed formula - write out a carbon, then you write everything attached, then next C, etc.



### 3. Bond-line formula



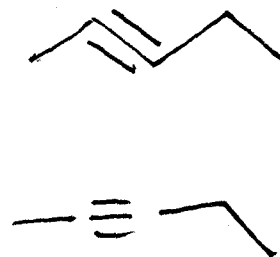
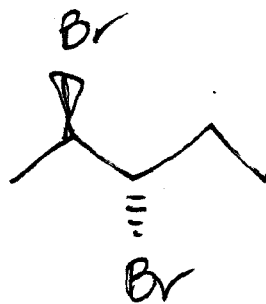
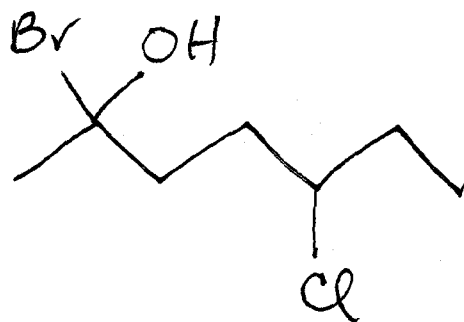
Don't write the H's  
unless attached to  
a heteroatom.

(heteroatom  $\neq$  C, H)

end of line = C  
(unless something  
else is written there)

every bend in the line  
is a carbon (unless  
something else is  
written there)

when drawing substituents-  
if the bend in <sup>the line</sup> goes up,  
the substituents go up



Draw all the isomers of  $C_4H_{10}O$ .

1. Do a SODAR calculation.

$$\frac{(2 \times \#C's) + 2 + \#trivalents_{(N)} - \#monovalents_{(H, X)}}{2}$$

Sum  
of  
Double  
bonds  
And  
Rings

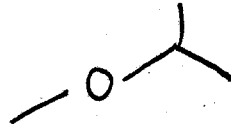
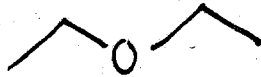
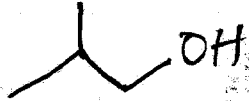
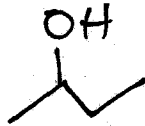
Always an integer  $\geq 0$

$$C_4H_{10}O : \frac{(2 \times 4) + 2 + 0 - 10}{2} = 0$$

2. All possible carbon skeletons



3. Add in  $\pi$  bonds / rings / heteroatoms.



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