4 different things attached to a central atom:

"things" = another atom or a lone pair

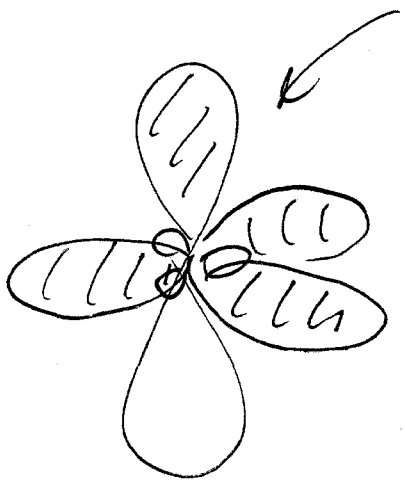
* tetrahedral geometry (109.5°)
* sp^3 hybridization

3 different things attached to a central atom:

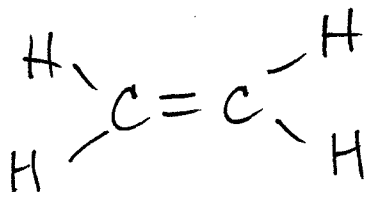
* VSEPR = trigonal planar (120°)
* sp^2 hybridization

$$s + 2p = 3\ sp^2$$

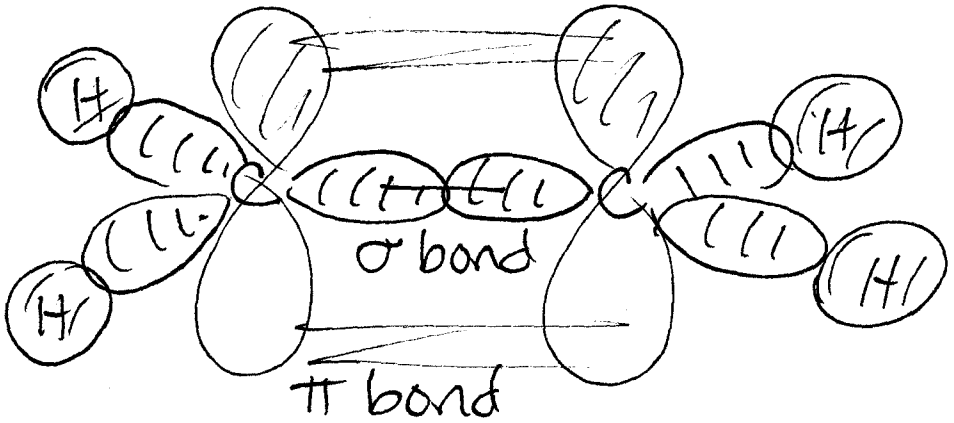
3 orbitals in a plane:



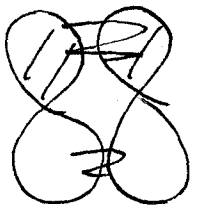
ex: ethene



sp^2:



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

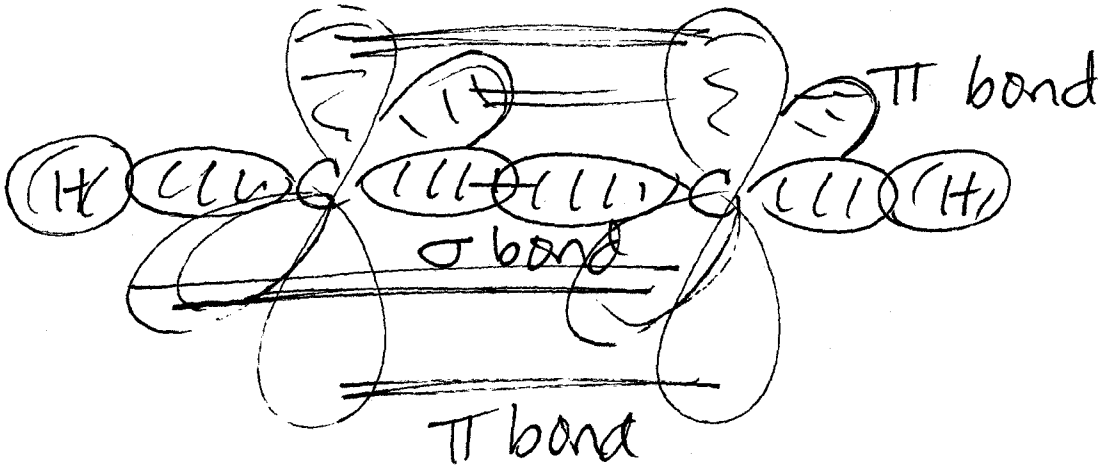


The π bond forces the molecule to be all in one plane - do not have free rotation about the C-C σ bond.

2 different things attached to a central atom.

* VSEPR says linear (180°)
* sp hybridized s + p = 2 sp
  2 unhybridized p-orbitals left over -
  ⊥ to hybrid orbitals and to each other.

ex. acetylene $H-C\equiv C-H$



No free rotation - p-orbitals must be parallel to form the π bond.

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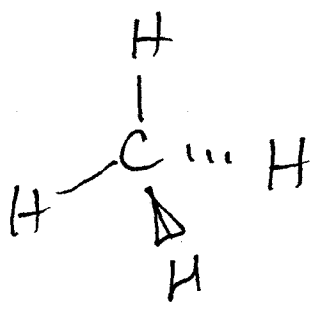
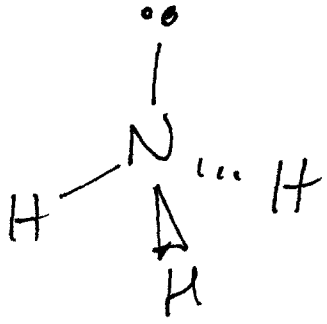
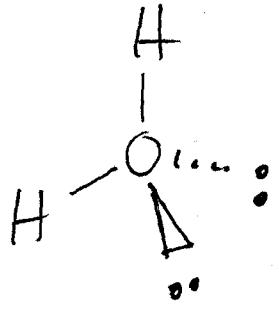
sp^3 tetrahedral ⇒ trig. pyramidal ⇒ bent

sp^2 trig. planar ⇒ bent

sp linear





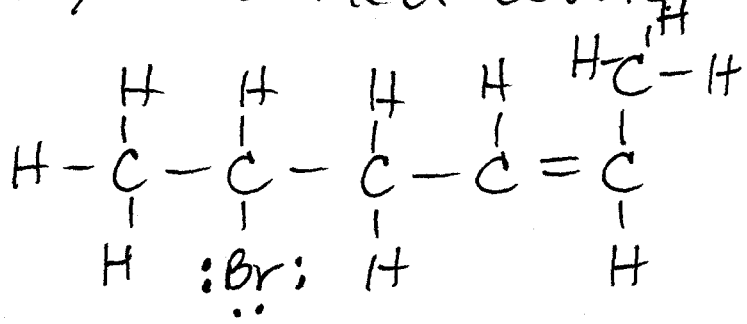


covalent bond lengths are very consistent.

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

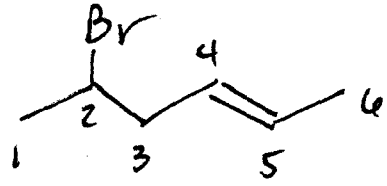
1. Lewis/modified Lewis



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

$CH_3CHBrCH_2CH{=}CHCH_3$

3. Bond-line formula

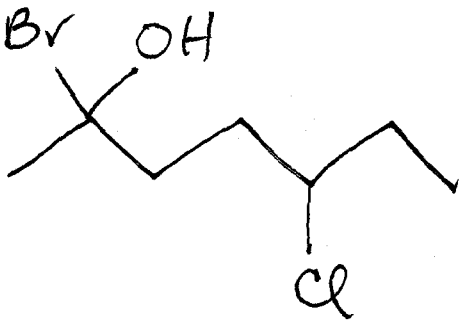


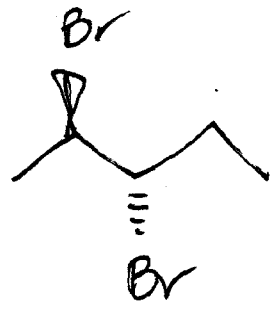
end of line = C
(unless something else is written there)

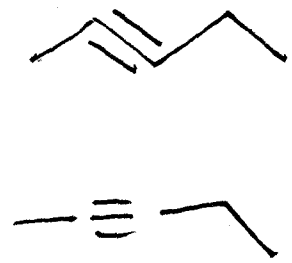
Don't write the H's unless attached to a heteroatom.
(heteroatom ≠ C, H)

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

When drawing substituents- IF the bend in the line goes up, the substituents go up







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

1. Do a SODAR calculation.

$$\frac{(2 \times \#C\text{'s}) + 2 + \#\underset{(N)}{\text{trivalents}} - \#\underset{(H,X)}{\text{monovalents}}}{2}$$

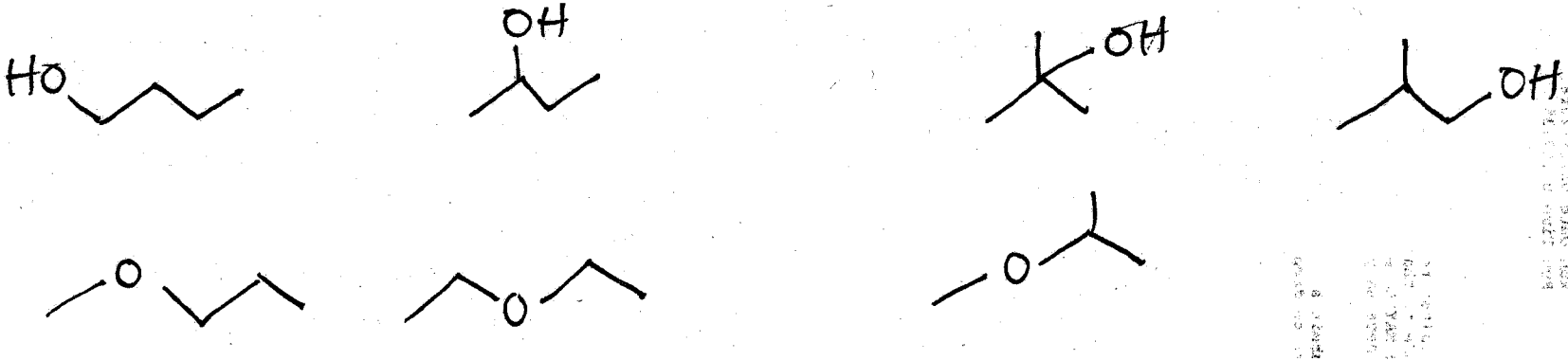
Sum of Double bonds And Rings

Always an integer ≥ 0

$C_4H_{10}O$: $\dfrac{(2\times4) + 2 + 0 - 10}{2} = 0$

2. All possible carbon skeletons

3. Add in π bonds / rings / heteroatoms.


HO
OH
OH
OH
O
O
O