OCSP 2020 | Lecture #1

Welcome to Day 1! :)

- Lectures M/W/F
- Study groups Tu/Th (starts tomorrow!!)
- First exam on Friday (6/26)

Today’s agenda: Orgo-related general chemistry

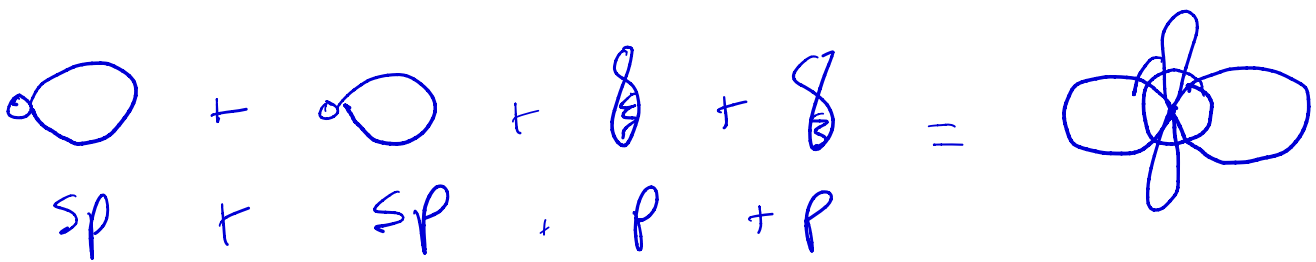
- Let’s review the following:
  - Hybridization
  - Formal Charge
  - Resonance
- Drawing structures in Organic Chemistry

Review of Hybridization: sp (+p+p)

- Molecules are SN2 or SN6
- Central atom has 2 or 6 groups (bonds/LP) around it
- Includes 2 sp hybrids and 2 p orbitals
- Molecular geometry= linear (w/2 bonds), bond angle= 180 degrees

↳ can vary w/ bond #

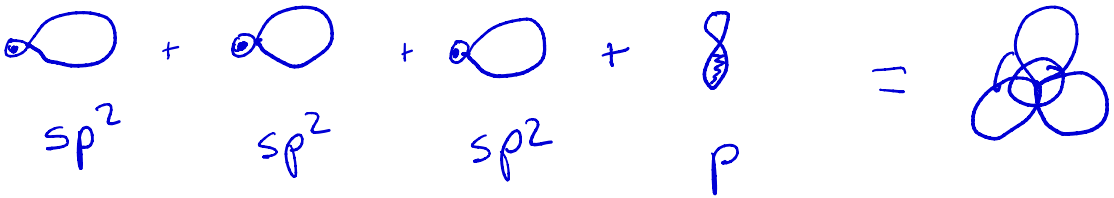
↳ decreases if LP, not bonds. LP take more space



Review of Hybridization: sp^2 (+p)

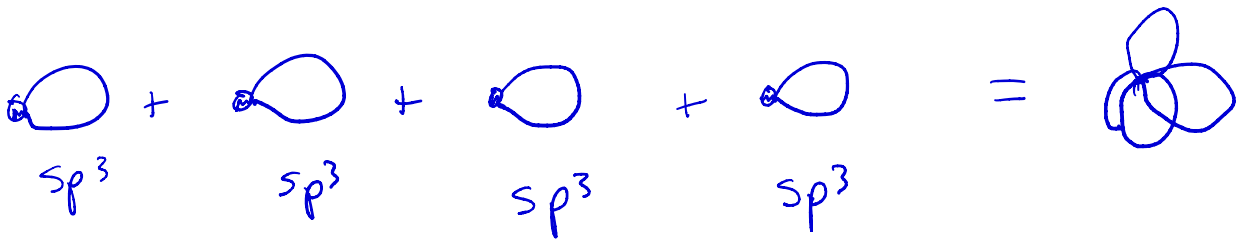
- Molecules are SN3 or SN5
- Central atom has 3 or 5 groups around it
- Includes 3 sp^2 hybrids and 1 p orbital
- Molecular geometry= trigonal planar (w/3 bonds), angle=120 degrees

↳ vary w/ # of bonds ↳ decreases w/ # LP

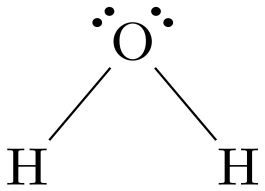


Review of Hybridization: sp^3

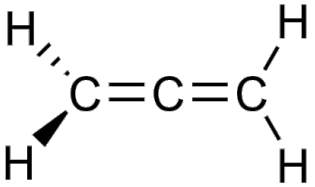
- Molecules are SN4
- Central atom has 4 groups around it
- Includes 4 sp^3 hybrid orbitals
- Molecular geometry=tetrahedral (w/four bonds), bond angle=109.5 deg



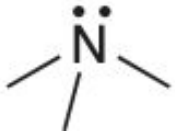
What's the hybridization of the following molecules?



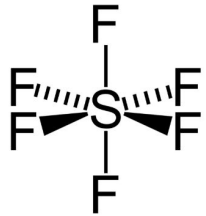
sp^3
4 groups



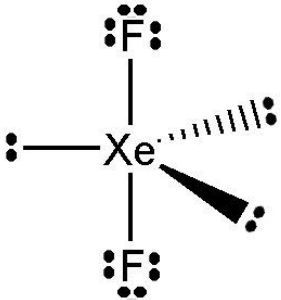
sp
2 groups around



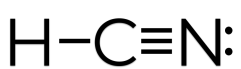
sp^3
4 groups



sp
6 groups around

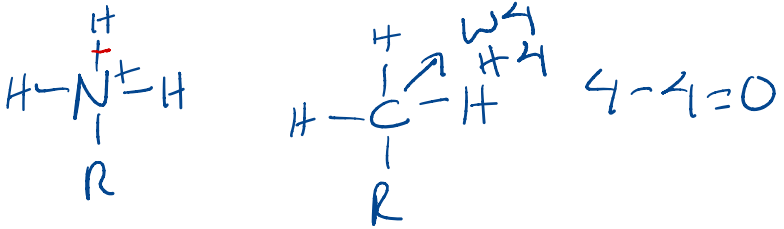


sp^2
5 groups



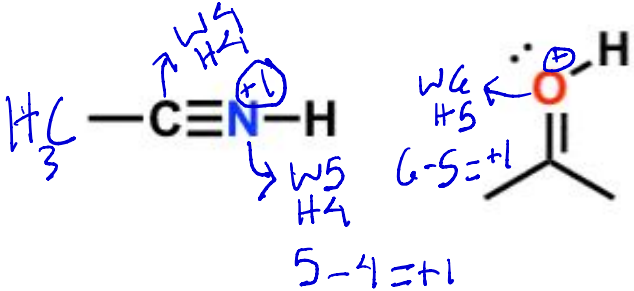
sp
2 groups around

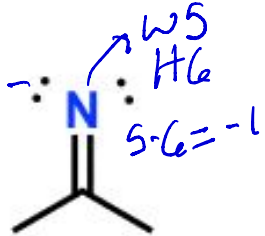
Formal Charge

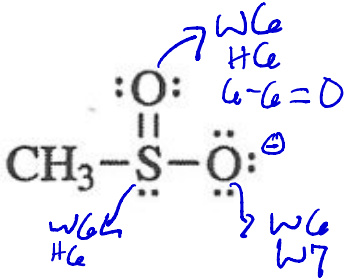


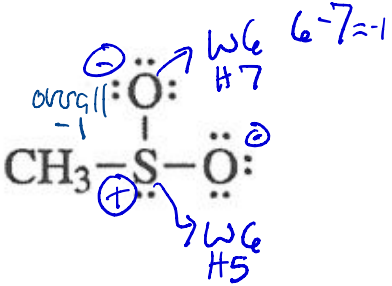
- Easy steps for calculating formal charge:
  - How many electrons ***should*** the central atom have around it?
  - How many electrons ***does*** the central atom have around it?
  - **Formal charge** = (# of electrons atom ***should*** have) - (# of electrons it ***does*** have)
- Examples:

- Each bond has 2 e⁻s → 1 goes to atom
- add charge of all atoms → overall formal charge



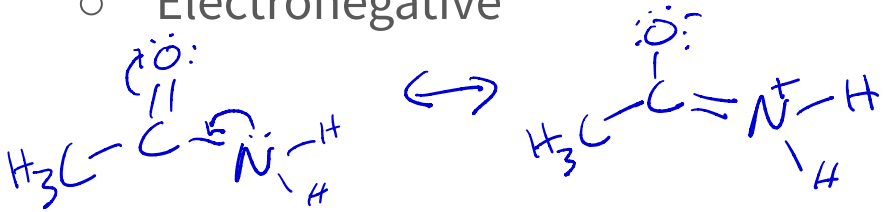




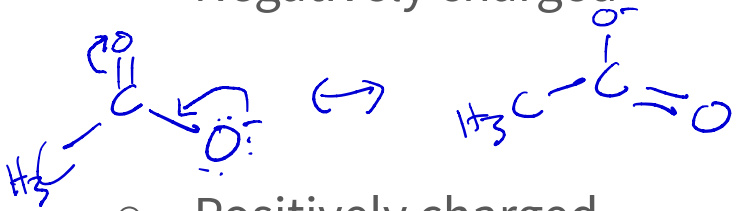


Resonance

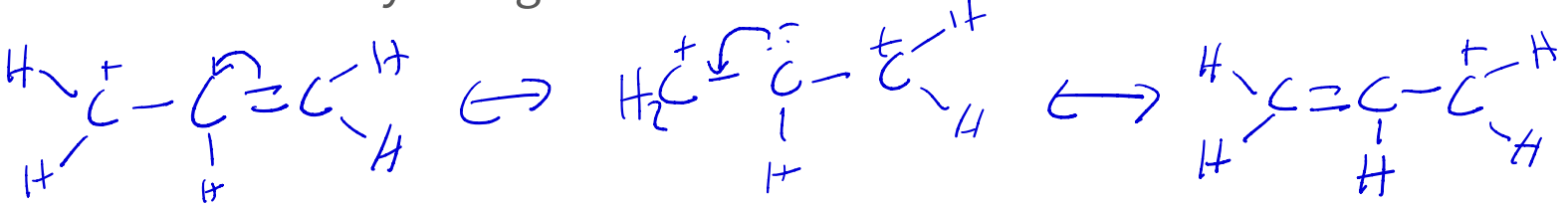
- Shows localization of electrons on different atoms in a molecule
- Molecules can have positive, negative, or neutral charge
- Occurs when a double bond is next to an atom that is:
  - Electronegative



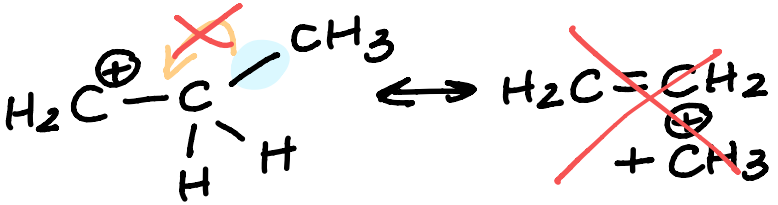
  - Negatively charged



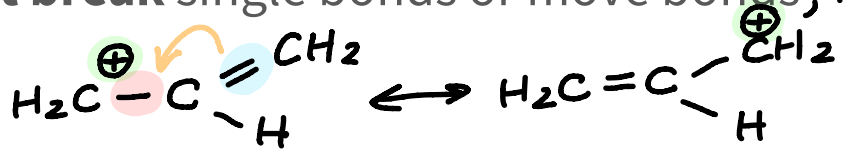
  - Positively charged



Resonance

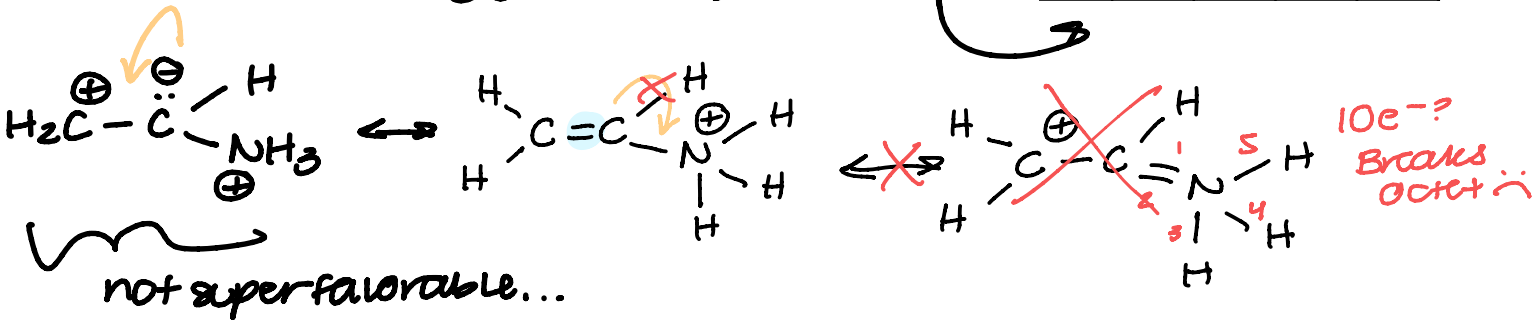


- Two rules for resonance:
  - **Don't break** single bonds or move bonds; look for = or ≡ (double) (triple)

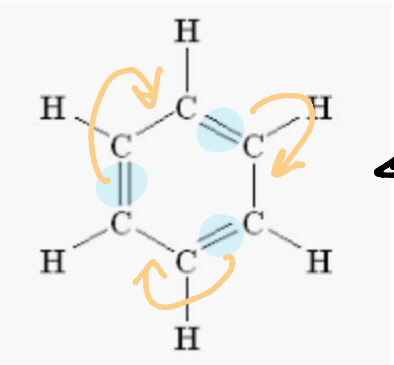


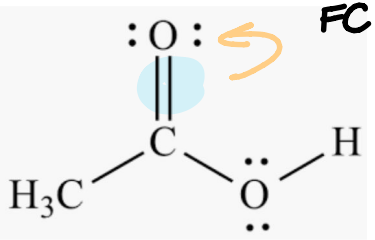
  - **Don't exceed octet** for 2nd row elements → sulfur (S)

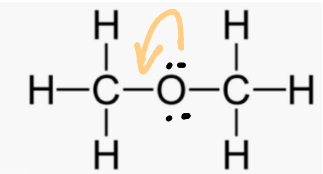
14	15	16	17	Helium 4.003
6 C Carbon 12.011	7 N Nitrogen 14.007	8 O Oxygen 15.999	9 F Fluorine 18.998	10 Ne Neon 20.180

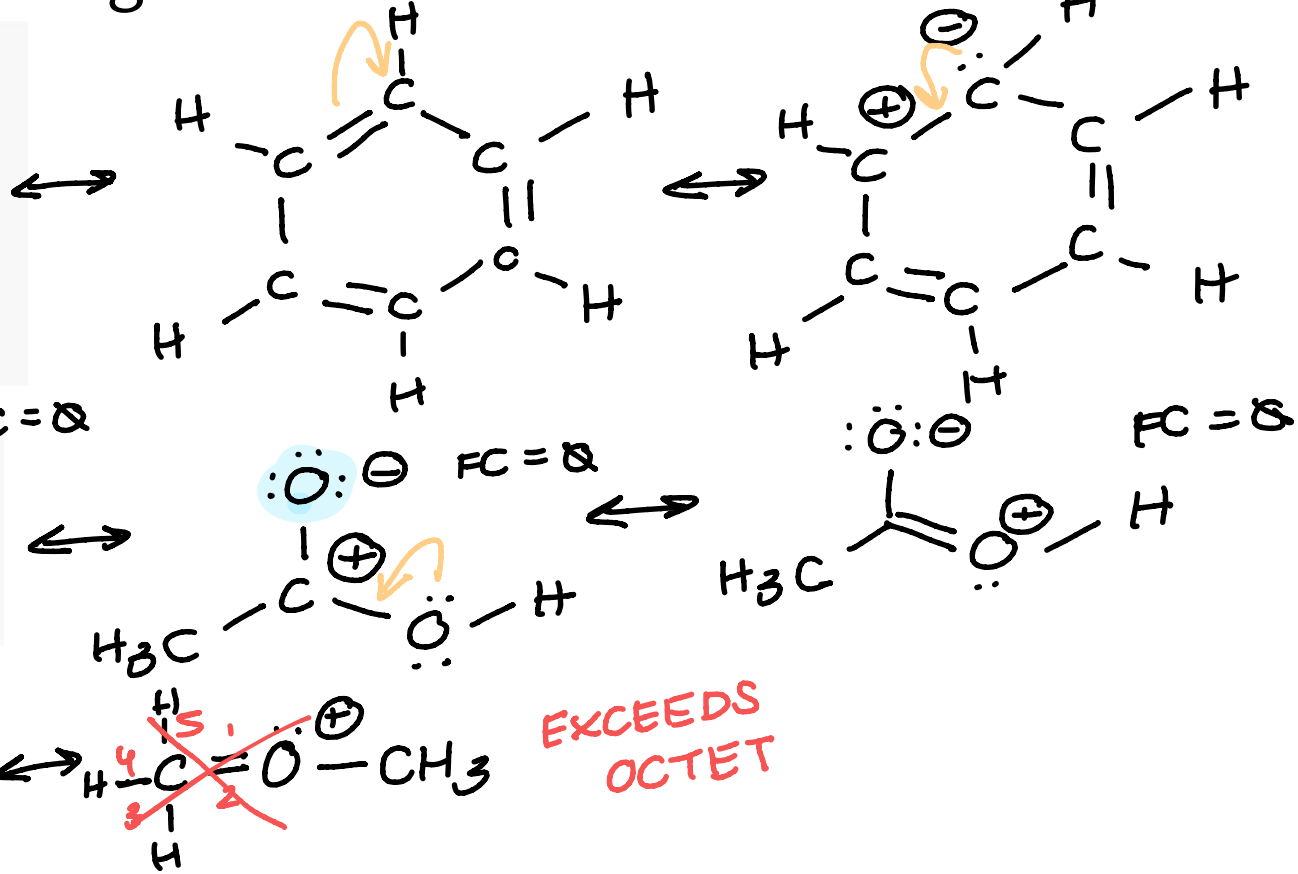


Do the following structures have resonance?



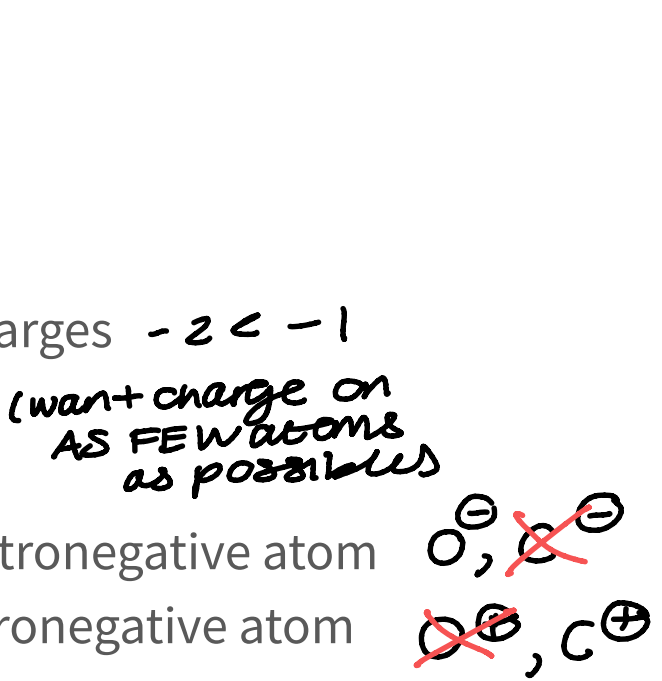




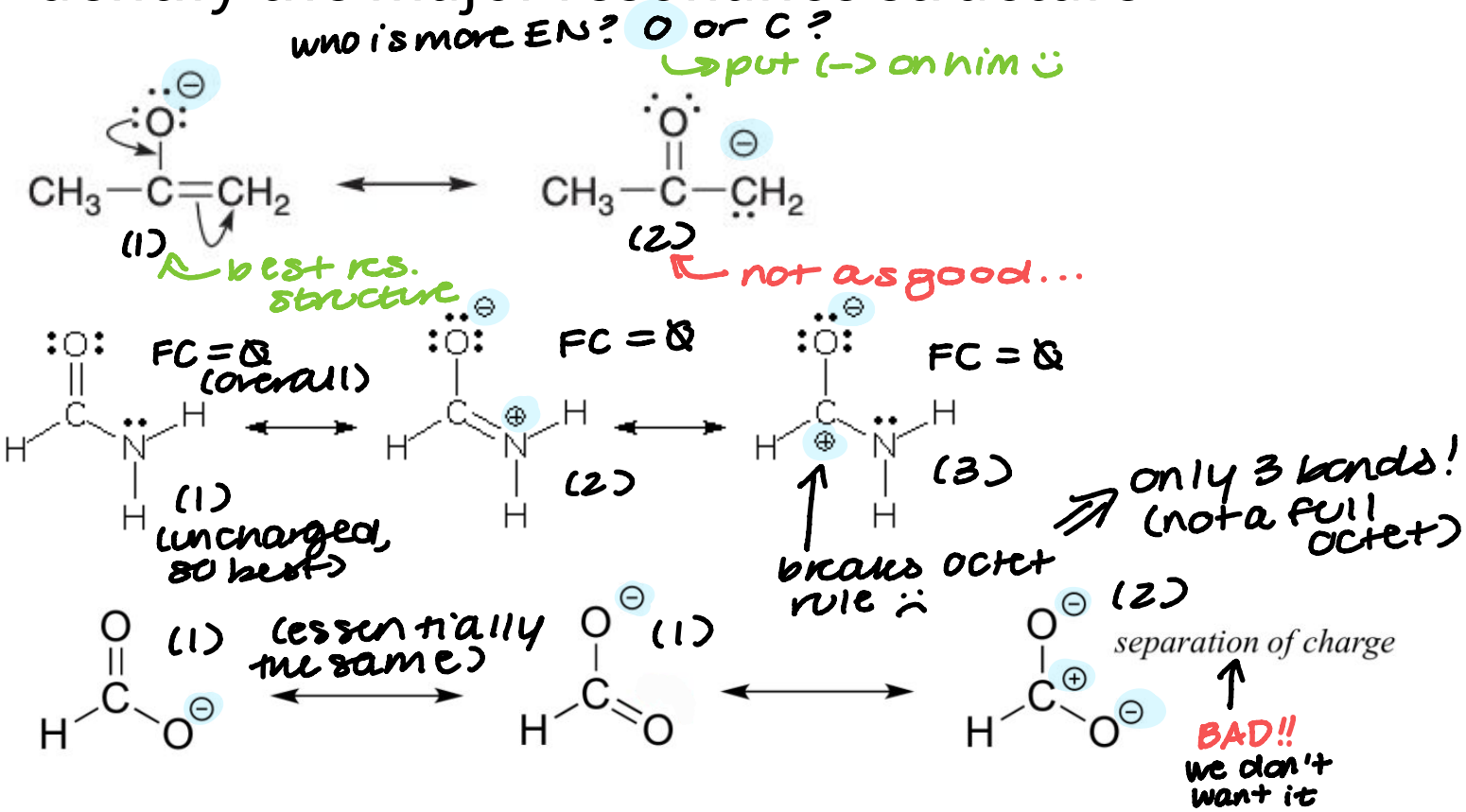


Resonance

- The best resonance structures have...
  - **Full octets** on all atoms
  - The **least number** of overall formal charges
  - The **least separation** of formal charge
  - Or, if charged:
    - **Negative** charge on the **most** electronegative atom
    - **Positive** charge on the **least** electronegative atom
- As with everything in orgo: *stability is key*

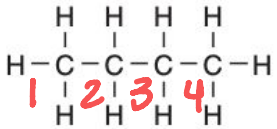


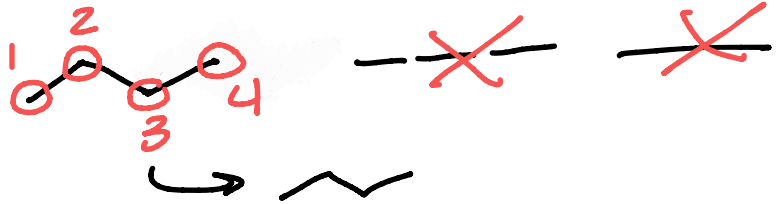
Identify the major resonance structure



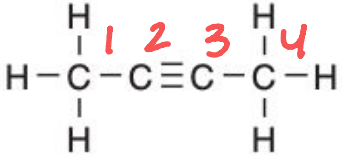
Drawing organic molecules

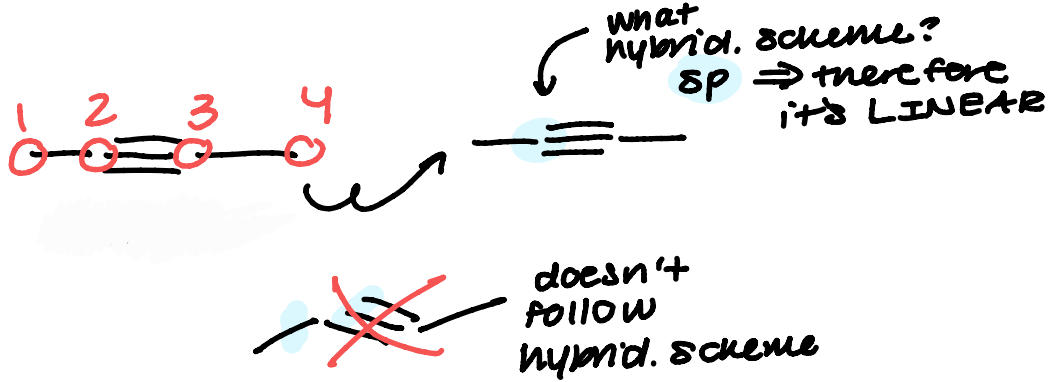
- Lines = bonds, at each angle = C
- H's are not drawn if attached to a carbon



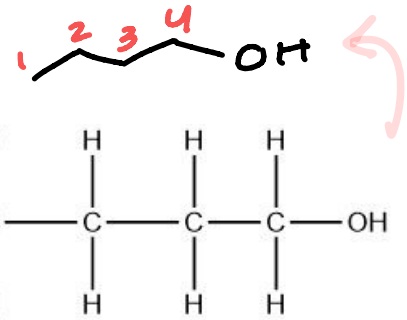


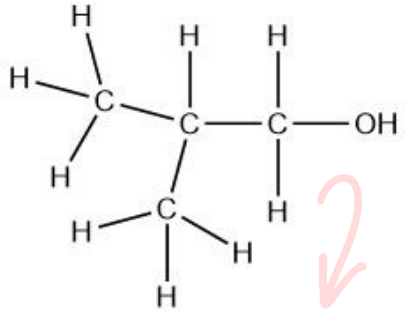
- For triple bonds:

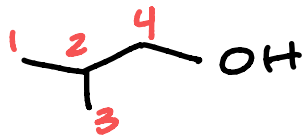


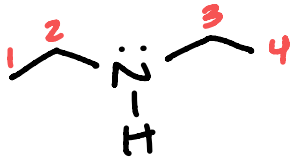


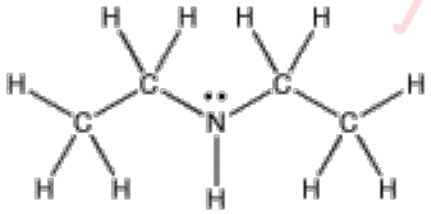
More structure-drawing :)

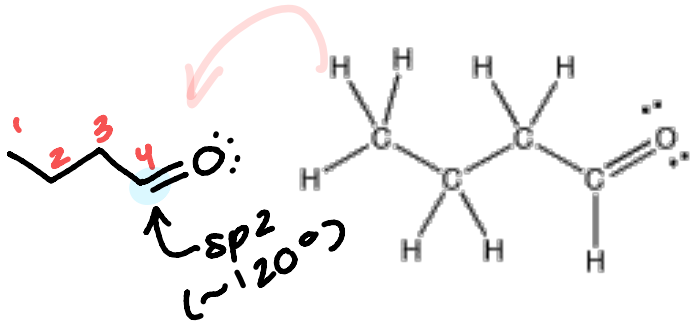




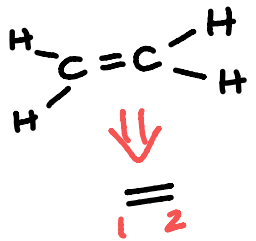


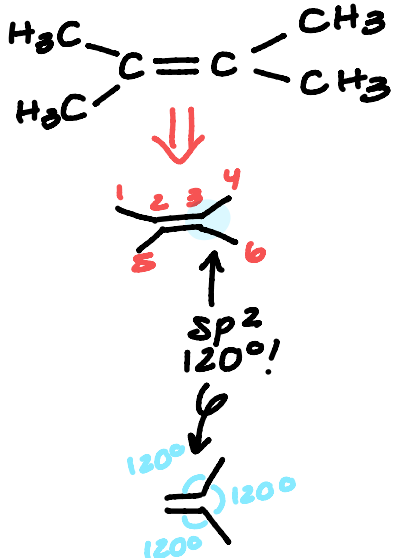






OTHER EX.





Drawing organic molecules

- Lines = bonds, at each angle = C
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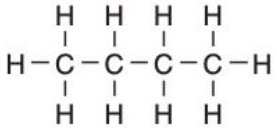
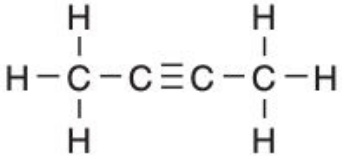


- For triple bonds:



More structure-drawing :)