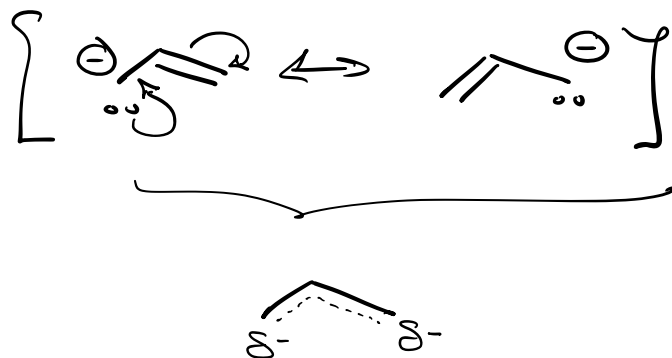


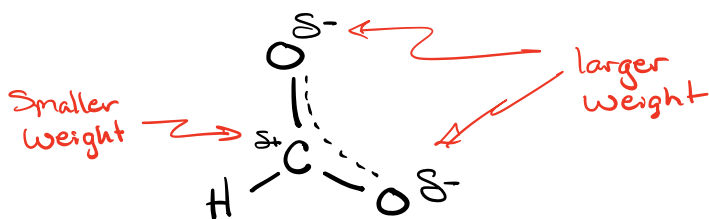
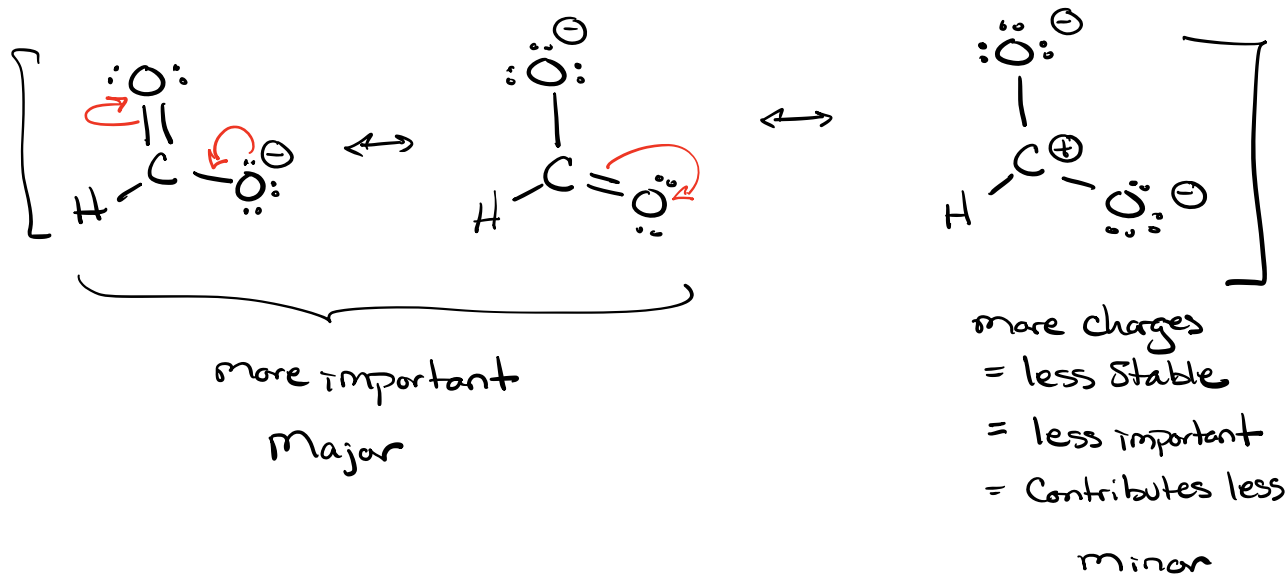


- Resonance is a model theory
 \Rightarrow A tool for understanding e^{-} flow within a molecule.

- Resonance is not an equilibrium.
 Individual Resonance structures do not exist.



- The true molecule is a hybrid or sum of all of the resonance contributors.
- Not all resonance structures are equal.
 Some structures are weighted more than other based on rules.



Resonance Rules

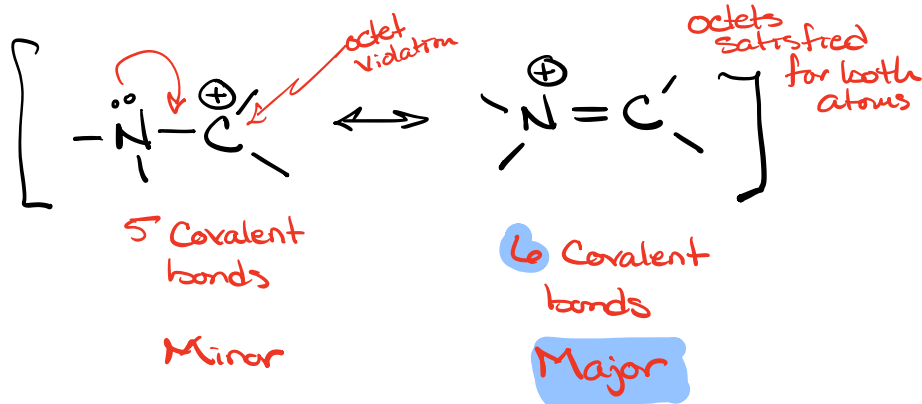
- ① must maintain same atom connectivity
* do not break σ bonds, only π & lone pairs involved in resonance.

- ② All structures must have the same # of paired and unpaired e^-

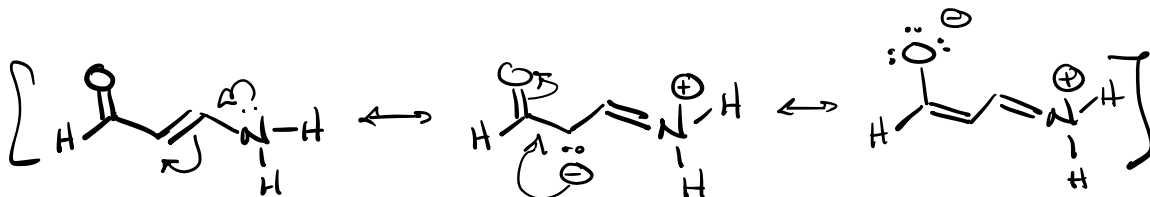
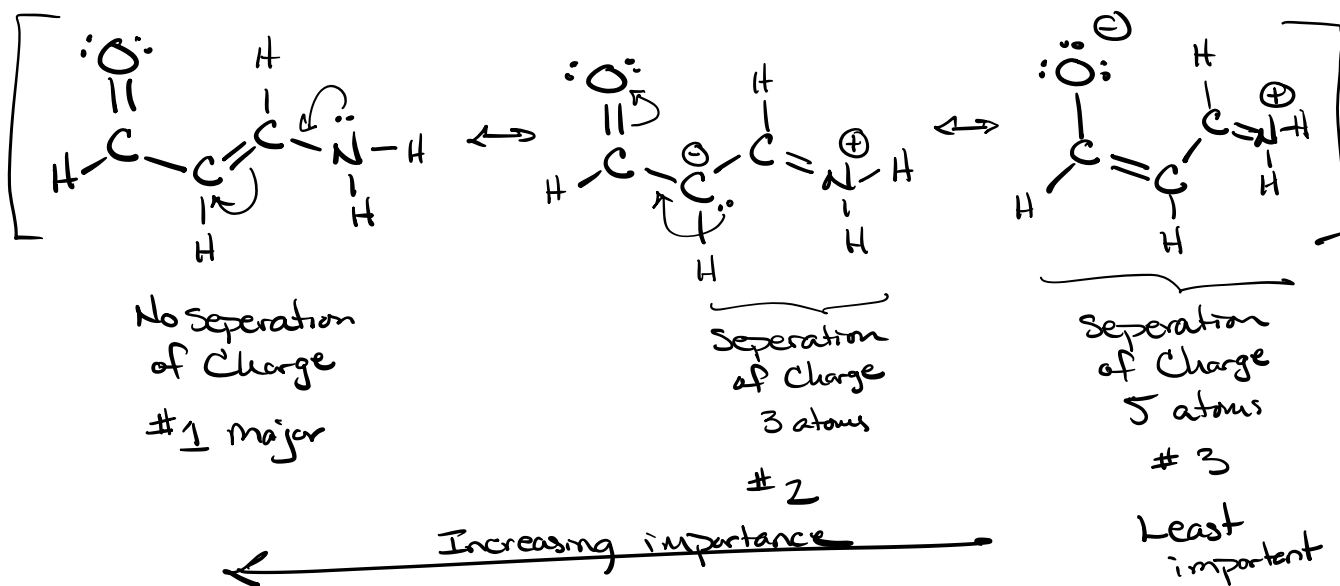


* ③ Contributors with more Covalent bonds are more important than those with less Covalent bonds.

⇒ Octet Rule

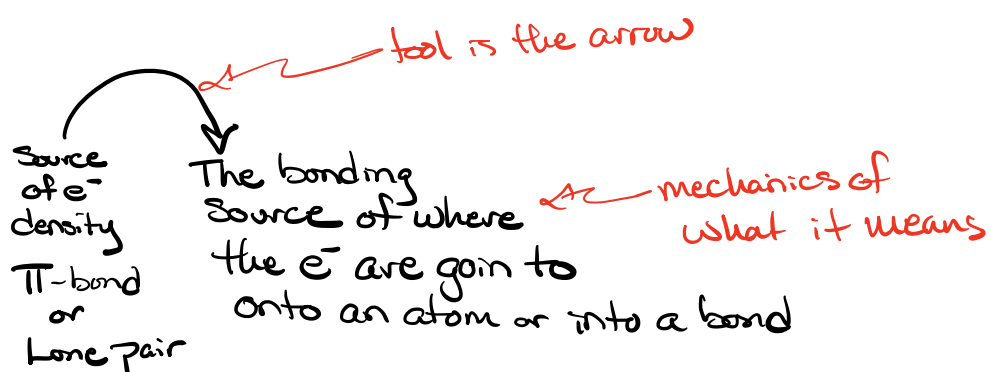


④ Little or no separation of charge is more important than large separation of charge




- ⑤ When charges are present, it is more stable (favorable) for the negative \ominus on the more electronegative element.

Tools & mechanics of Resonance



The curved arrow shows the flow of $2e^-$

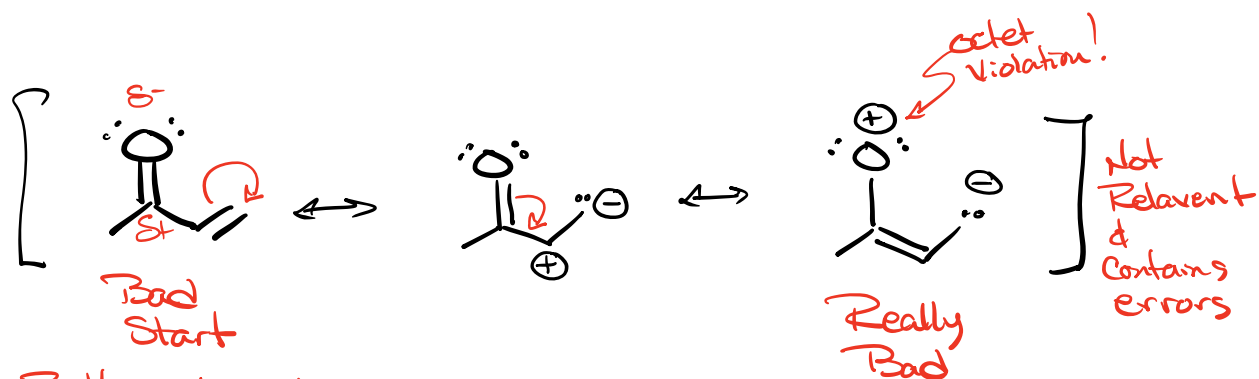
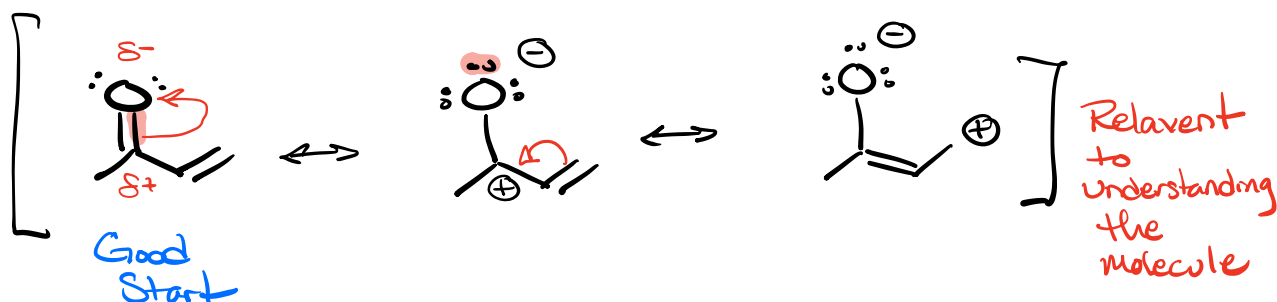
 Fishhook arrow. Reserved for free Radical resonance. Shows movement of single e^- .

Resonance Patterns

Usually we don't do resonance with neutral molecules. We usually use resonance to explore the stability of charged species.

Neutral Molecules – most difficult to start with

where to start ??? work with polarity of molecule!

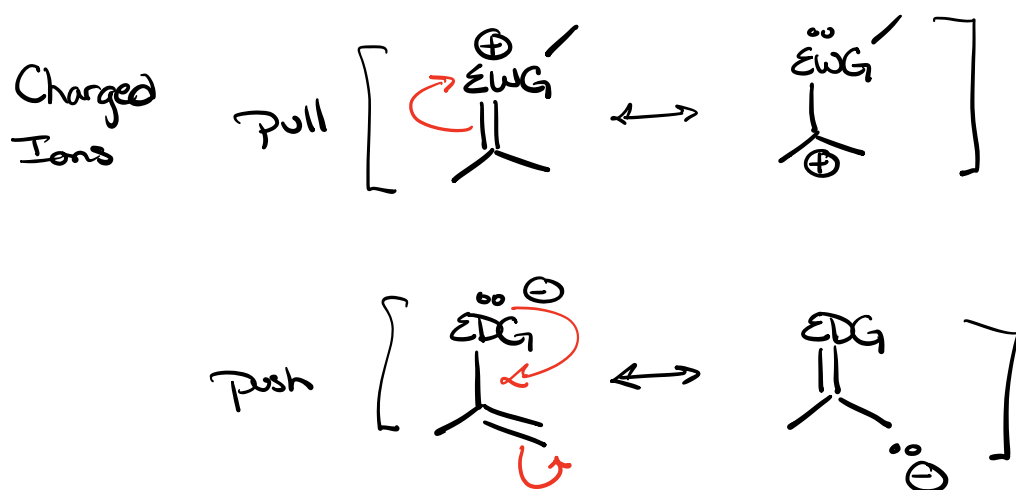
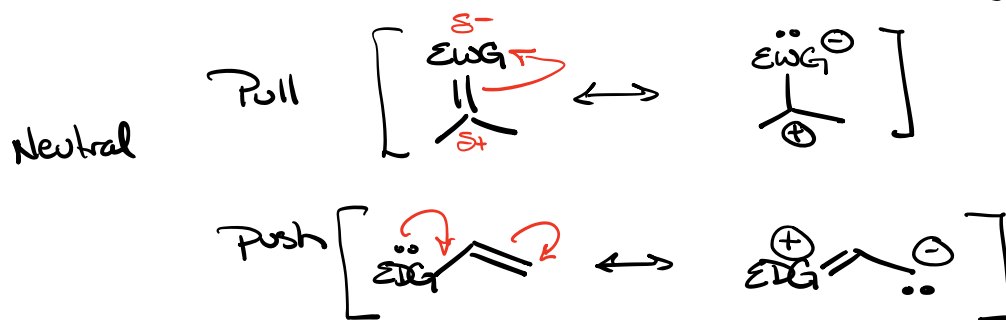


Both carbons have same EN. No natural polarity followed

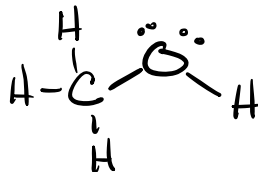
Really Bad
Octet violation for oxygen.
Oxygen has only 6e⁻

Common Patterns

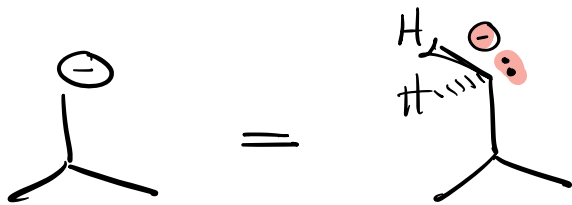
EWG = Electron withdrawing group (pulls)
EDG = Electron Donating group (pushes)



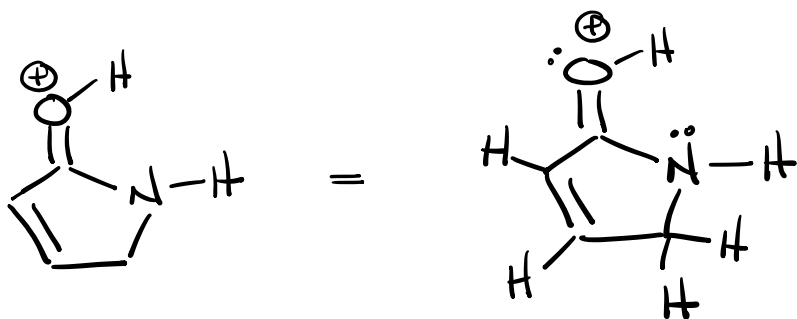
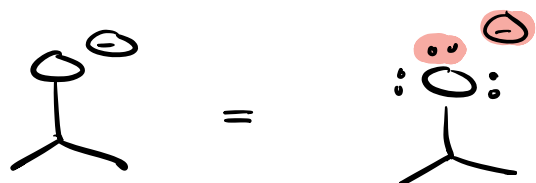
* A lone pair of e^- does not imply a negative charge



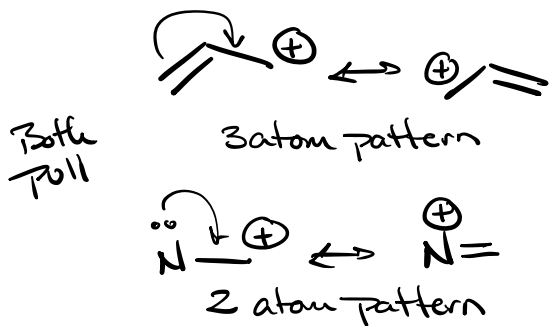
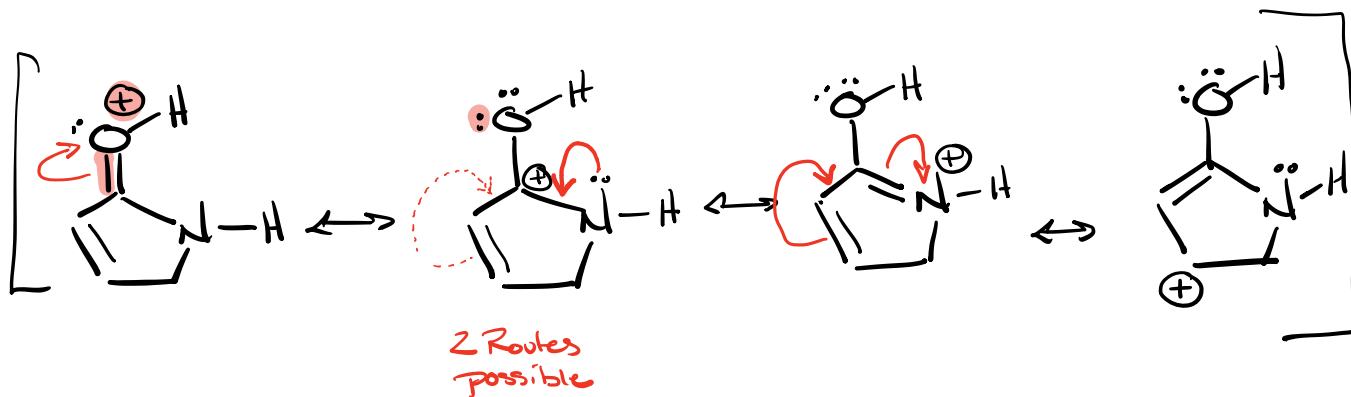
** A negative charge always implies a lone pair



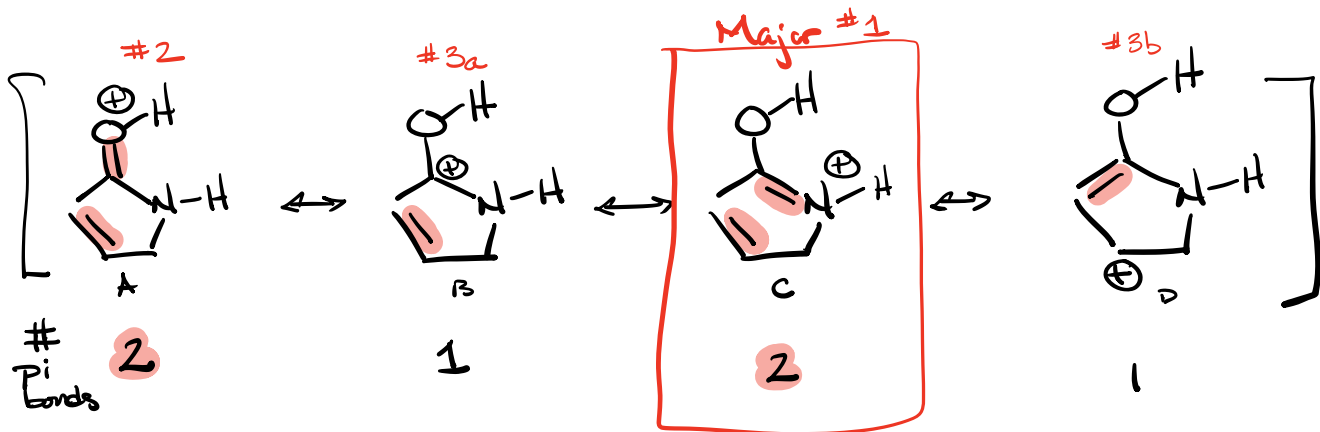
Lone pair is the source of negative charge



* no more than 4 bonds to Carbon.



- Always linear
- Never Branching
- Try not to create new Charges



where
is
charge

3.5
Oxygen
⊕

3.0
Nitrogen
⊕

CNOF
→

If oxygen pulls e^-
more strongly, then
nitrogen is more willing
to donate e^-