

Chapter 3: Polar Covalent Bonds; Acids and Bases

Concepts to Review from General Chemistry:

- ✓ Electronic Structure
 - ✓ Molecular Orbitals and Atomic Orbitals
 - ✓ Bonding and Antibonding
 - ✓ Lewis, Condensed, or Kekule Structures
 - ✓ Determining Formal Charge
 - Resonance!!
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- Brønsted-Lowry Acids and Bases
 - Organic Acids and Bases
 - Acid Dissociation Constants - pK_a and pH
 - Lewis Acids and Bases –
 - Nucleophiles and Electrophiles

Patterns in Resonance

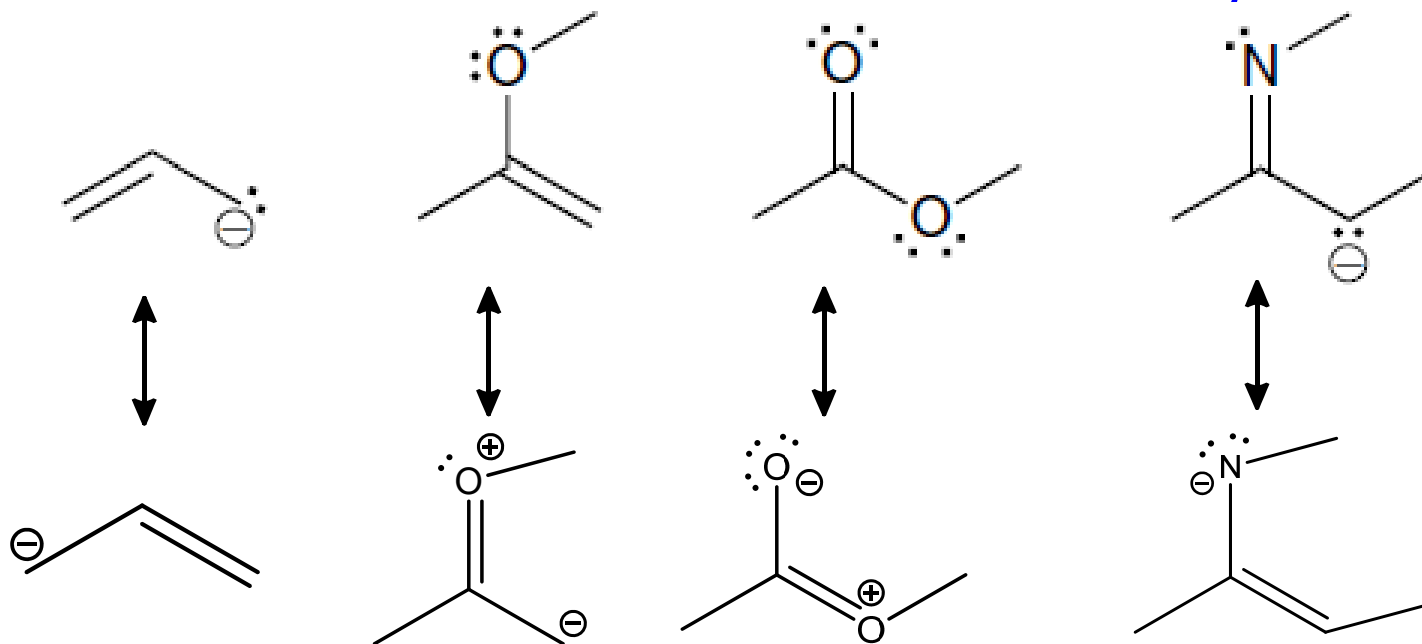
There are 5 main bonding patterns in which resonance occurs. Recognize these patterns to predict when resonance will occur:

1. Allylic lone pairs
2. Allylic positive charge
3. Lone pair of electrons adjacent to a positive charge
4. A pi bond between two atoms with different electronegativities
5. Conjugated pi bonds in a ring

Patterns in Resonance

1. Identifying allylic lone pairs:

- For each of the following, show the resulting resonance contributor and all formal charges



- If I started with one charge – still have one charge. Started neutral – still neutral, but now one positive and one negative charge.

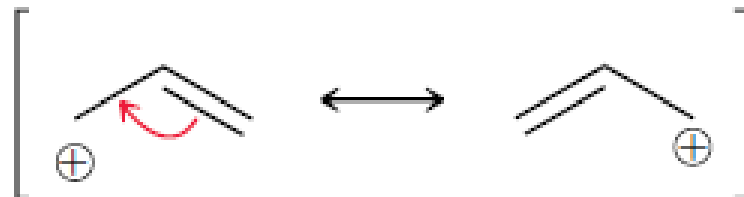
Patterns in Resonance

2. Dealing with allylic positive charge

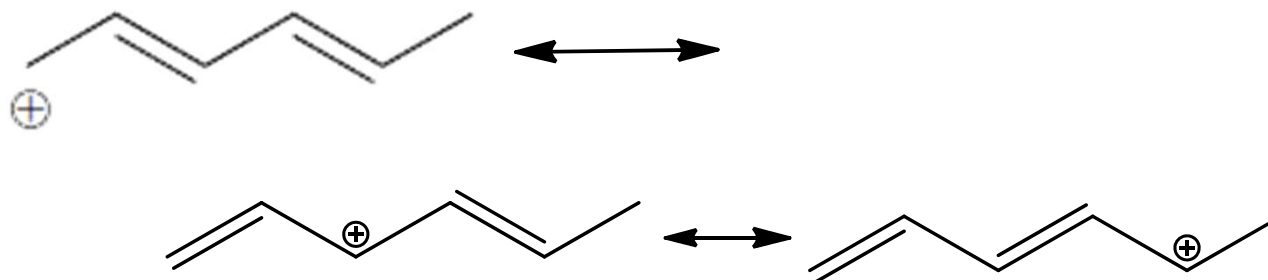
- Only one curved arrow is needed.



Allylic positive charge



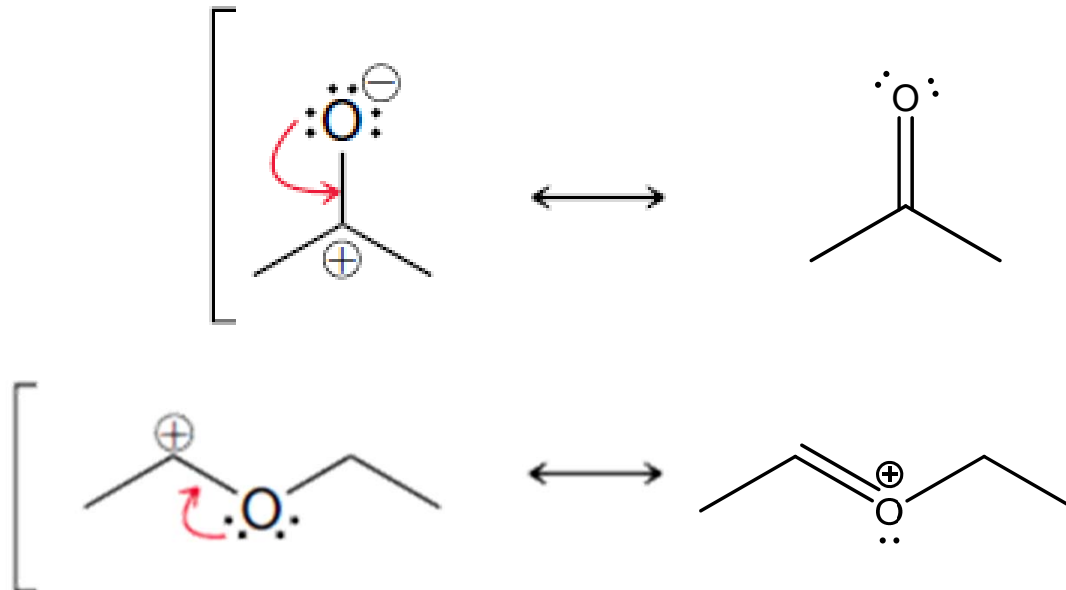
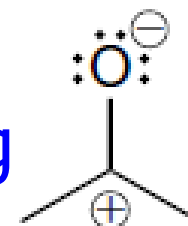
- If there are multiple conjugated double bonds, then multiple contributors are possible. Show the resonance contributors and curved arrows below.



Patterns in Resonance

3. A lone pair adjacent to a positive charge

- Only one arrow is needed.
- Show the resonance contributors and curved arrows below. Draw a resonance hybrid.



Patterns in Resonance

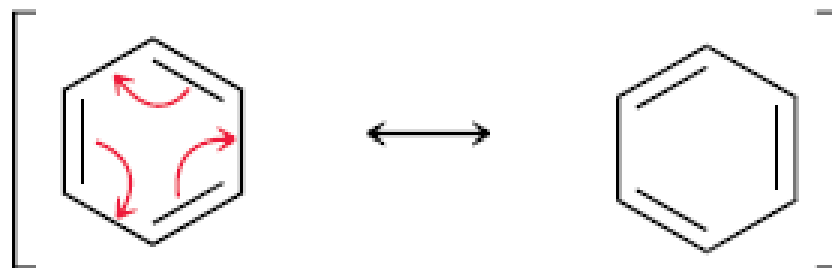
4. A pi bond between atoms of different electronegativity:
- The pi electrons will be more attracted to the more electronegative atom.



Patterns in Resonance

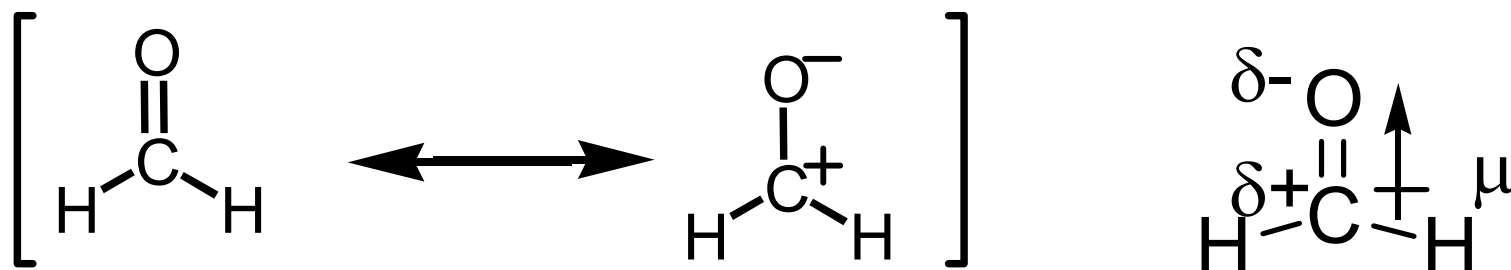
5. Conjugated pi bonds in a ring:

- Each atom in the ring MUST have an unhybridized p orbital that can overlap with its neighbors.



Major and Minor Contributors

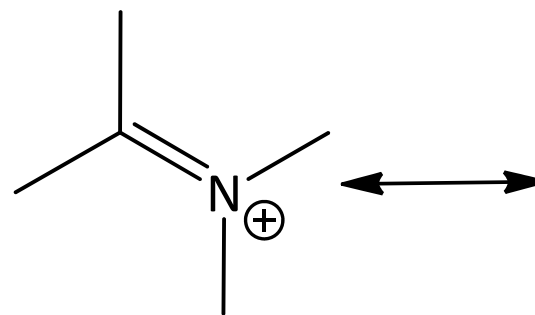
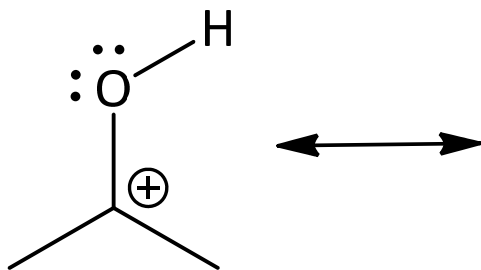
- ▶ Certain resonance structures are more stable than others (i.e. of lower energy).
- ▶ These are said to be **major** contributors, whereas higher energy structures are **minor** contributors.
- ▶ The real structure will resemble the major contributor **more** than it does the minor contributor.



Consider formaldehyde, even though the minor contributor is of higher energy than its double bonded counterpart, its contribution helps explain the polarization of the double bond.

Stability of Contributors

- ◆ The octet rule is usually a bigger factor than formal charge when assessing stability.
- ◆ For each structure, assess the stability of each contributor, and draw a resonance hybrid.



For Next Time....

- ▶ Monday is a HOLIDAY
- ▶ WEDNESDAY Chapter 3 (3.5 – 3.8)
- ▶ Friday Start Chapter 4 (4.1 – 4.5)
 - ▶ BRING YOUR MODEL SET!
- ▶ Homework Problems Chapter 3
#1,4,7,15,34,35,37,39,43,44, 47