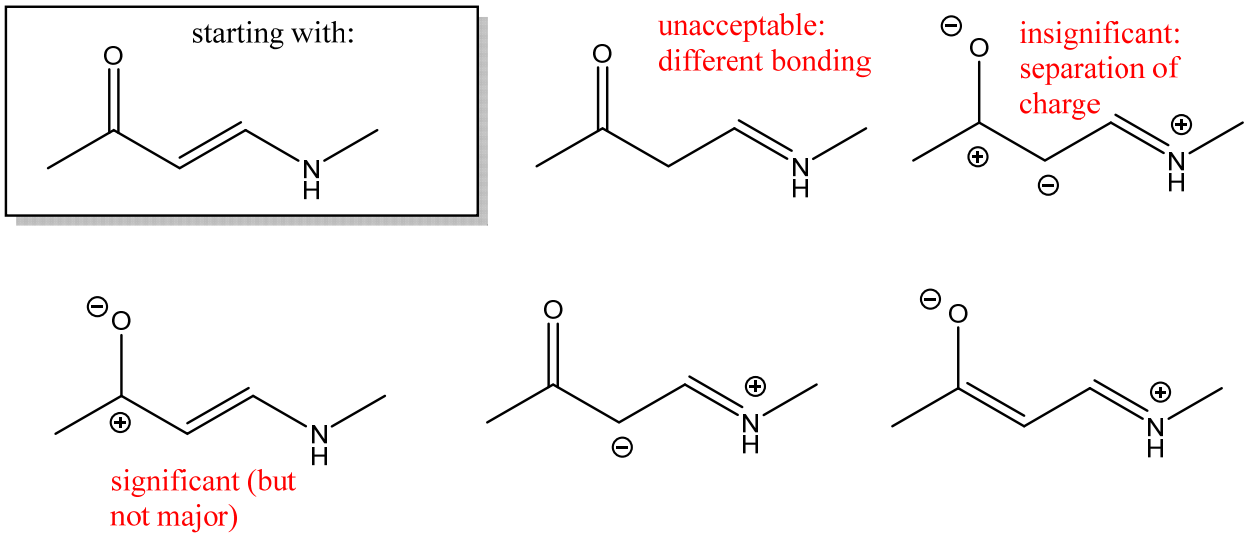
Discussion Worksheet #1 Partial Answers
Resonance

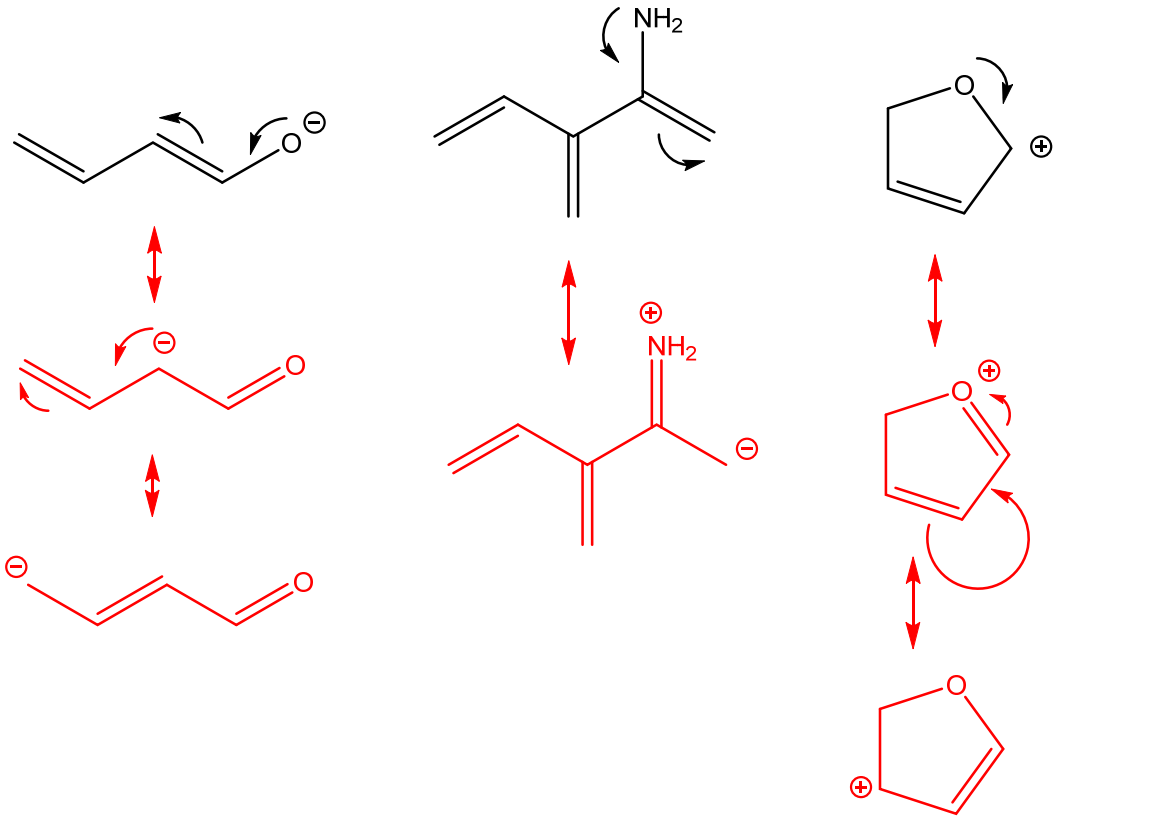
Skill 1: Drawing significant resonance structures

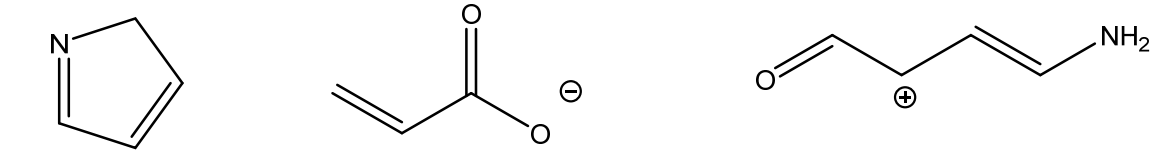
- Identify and use bonding patterns in molecules to draw acceptable resonance structures
- Check structures to ensure proper formal charge
- Identify which resonance structures are major, which are significant, and which are insignificant

Problem 1. Identify each of these structures as unacceptable, major, significant or insignificant.



Problem 2. Draw all significant resonances structures for these compounds. Indicate any that are major contributors.

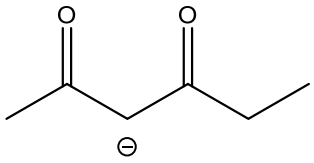

NH2
O
NH2
O

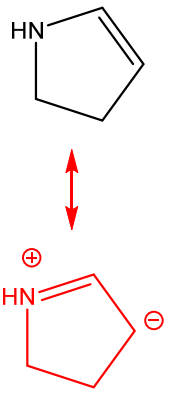

N
O
O
NH2
O

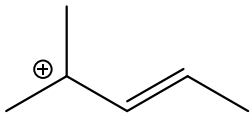
Skill 2: Identify electron rich and poor atoms in a molecule

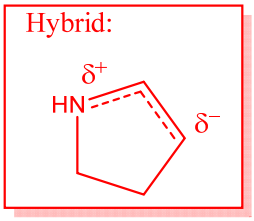
- Look for bond dipoles to identify partial positive and partial negative atoms in a molecule.
- Draw a resonance hybrid to identify partial positive and partial negative atoms in a molecule.

Problem 3. Draw resonance hybrids for these molecules. Indicate partially positive and partially negative atoms.

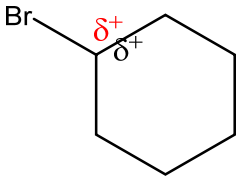




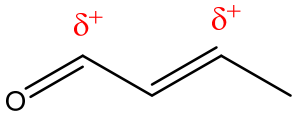




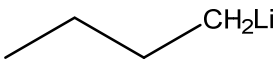
Problem 4. Indicate partially positive and partially negative carbon atoms in these molecules. Explain how you figured this out.

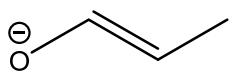


Draw a dipole moment



Draw a resonance hybrid



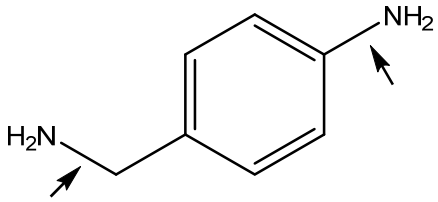


Skill 3: Apply resonance in structural analysis

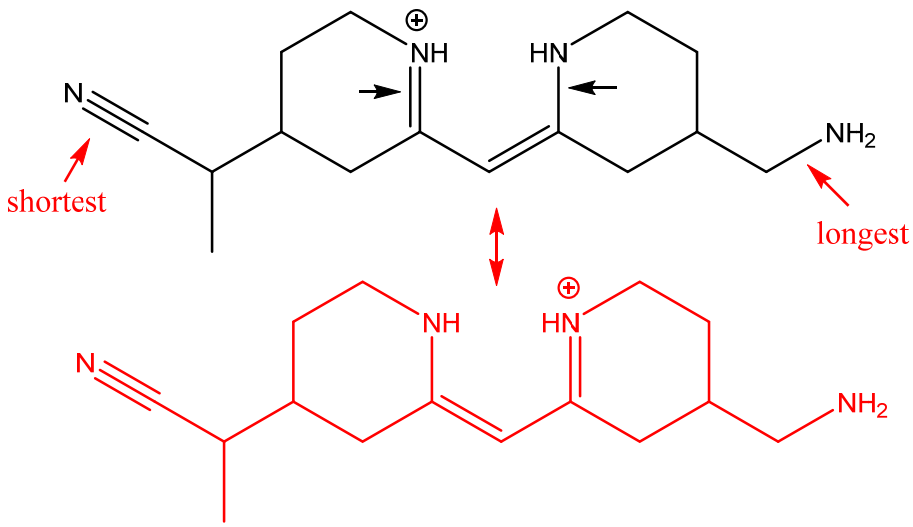
- When asked a question concerning structure, ALWAYS take into consideration all resonance contributors before answering.
- If an atom is sp^2 hybridized in one resonance contributor and sp^3 hybridized in another, it is actually sp^2 hybridized
- If a bond is a single bond in one contributor and a double bond in another, the actual bond order is in between single and double.

Problem 5. Explain why the carbon-nitrogen bond of an amide is typically stronger than the carbon nitrogen bond of an amine. Use structure in your answer.

Problem 6. One of the indicated bonds is much harder to rotate than the other. Explain.



Problem 7. Rank the following bonds from shortest to longest.



The two bonds in the middle are nearly identical because of resonance. Both are 1.5 bond order.