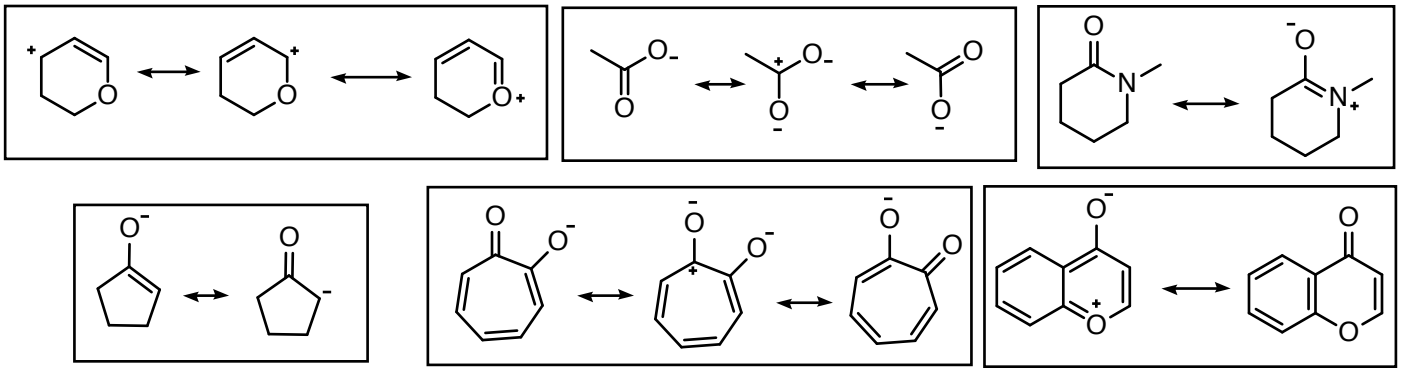
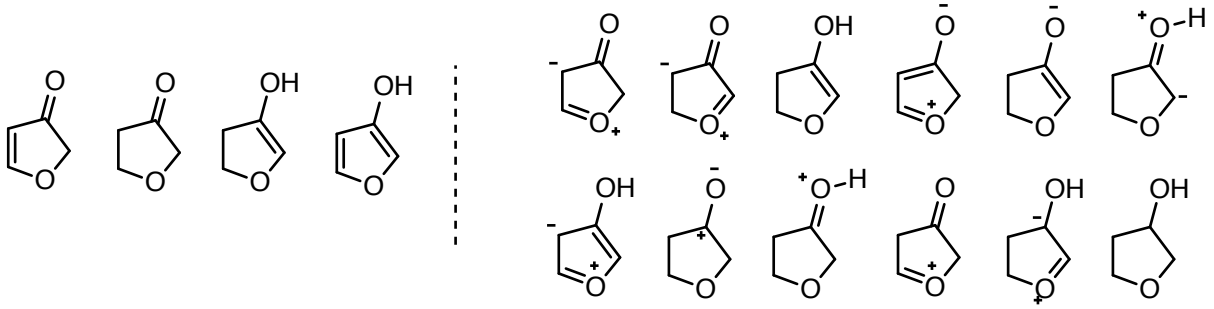
Worksheet 7: NMR Spectroscopy

Skill-Building Goals: Understand basics of electron arrow pushing. Be able to show how two or molecules are related (specifically how one can become the other, and visa versa) through electron arrow pushing. Use this skill to recognize alternative resonance forms and rank-order different resonance forms by how great of a contributor to the resonance hybrid the individual resonance forms are.

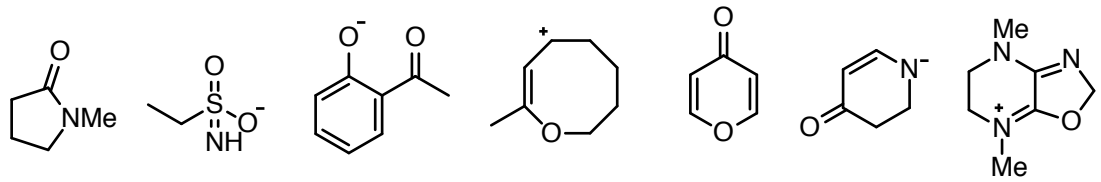
1. Show electron arrow pushing that illustrates the interconversion between the following series of resonance forms. Go in one direction (R to L), and then redraw and try and go in reverse direction (L to R).



2. For the molecule on the left, which of the molecules on the right represent resonance forms. Show their interconversion



3. Provide as many resonance forms of the following molecules you can think of. Rank them in order of relative contribution to resonance hybrid.



4. **WORKING TOGETHER.** For additional practive, try and draw charged molecule (+ or -) that has at least one resonance forms. Provide one of the forms to one of your friends and see if they can figure out what the other resonance form is. Increase level of difficulty by trying to think of molecules with lots of resonance forms.