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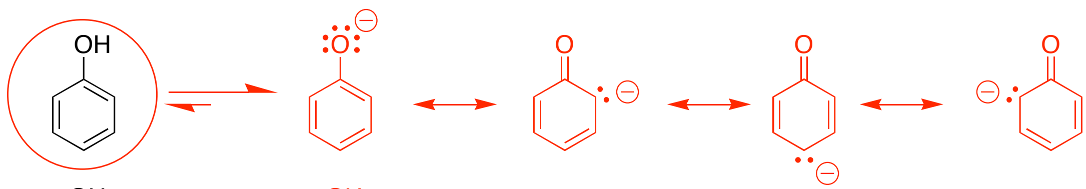
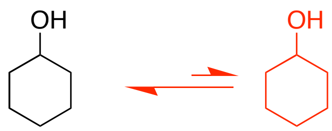
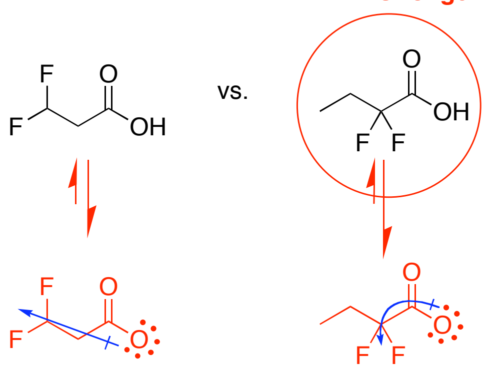
**1.** For each pair of molecules, circle the *stronger acid* and provide a reason for your decision. Use pictures as well as words in your explanation.

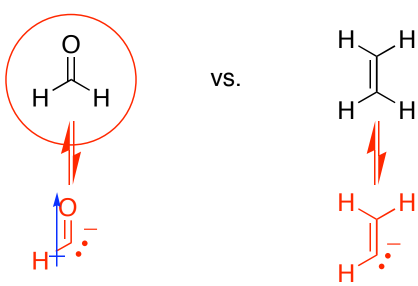



The conjugate base of the 1st acid can delocalize its negative charge through resonance. Spreading the charge to other areas of the molecule makes the conjugate base more stable, thus driving the reaction towards that side of the equilibrium. This, in turn, results in a stronger acid (it is more likely to give up its protons).

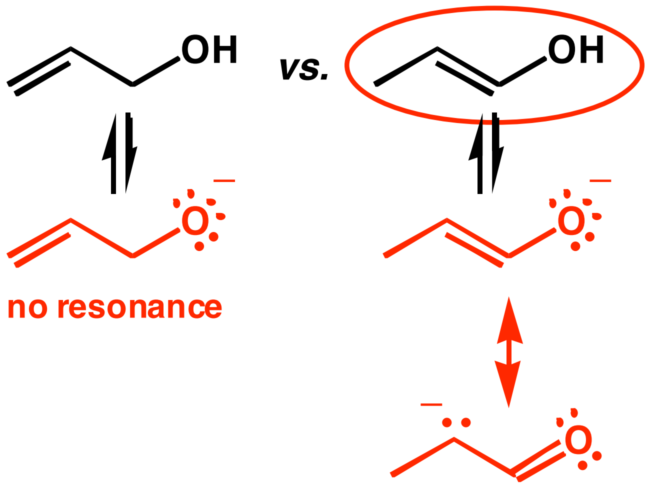



Both conjugate bases can be stabilized by induction. However, the electronegative fluorine groups in the 2nd molecule are closer to the negative charge and thus have a greater delocalizing effect than the fluorines in the 1st molecule. This greater delocalization results in a more stable conjugate base, driving the equilibrium to a greater extent than in the 1st molecule. The result is an acid more willing to release its protons.

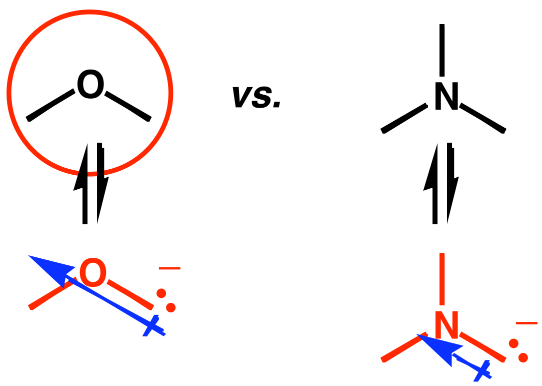



Neither of these molecules are very good acids b/c there is no possibility for resonance to help delocalize the charge. However, the 1st molecule contains oxygen, an electronegative atom. This creates an inductive effect that can help to delocalize the negative charge in the conjugate base. No such delocalization exists for the 2nd molecule. Thus, the conjugate base in the 1st molecule will be more stable and thus provide a greater driving force for the acid to give up its proton than the case for the 2nd molecule.

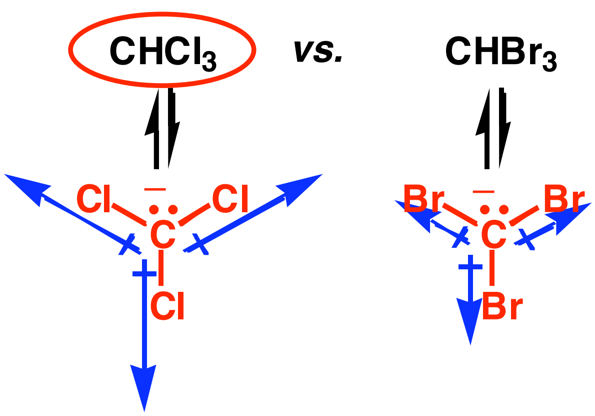
**2.** For each pair of molecules, circle the *stronger acid* and provide a reason for your decision. Your reason should include pictures as well as words.




The conjugate base of the 2nd acid can delocalize its negative charge through resonance. Spreading the charge to other areas of the molecule makes the conjugate base more stable, thus driving the reaction towards that side of the equilibrium. This, in turn, results in a stronger acid (it is more likely to give up its protons).




Oxygen is more electronegative than nitrogen. Therefore, it will pull more electron density towards it by induction than the nitrogen will. This will better delocalize the negative charge in the oxygen molecule than in the nitrogen molecule. Spreading the charge to other areas of the molecule makes the conjugate base more stable, thus driving the reaction towards that side of the equilibrium. This, in turn, results in a stronger acid (it is more likely to give up its protons).




Chlorine is more electronegative than bromine. Therefore, the 3 chlorines will pull more electron density towards them by induction than the bromines will. This will better delocalize the negative charge in the chlorine molecule than in the bromine molecule. Spreading the charge to other areas of the molecule makes the conjugate base more stable, thus driving the reaction towards that side of the equilibrium. This, in turn, results in a stronger acid (it is more likely to give up its protons).

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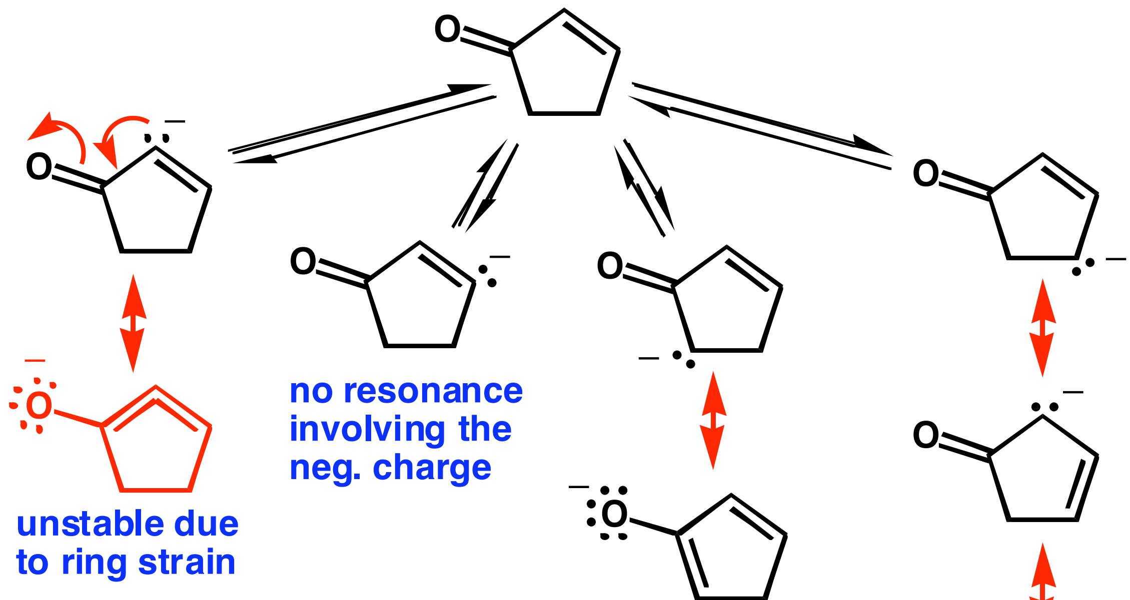
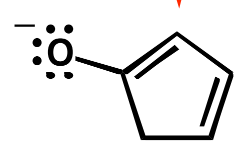
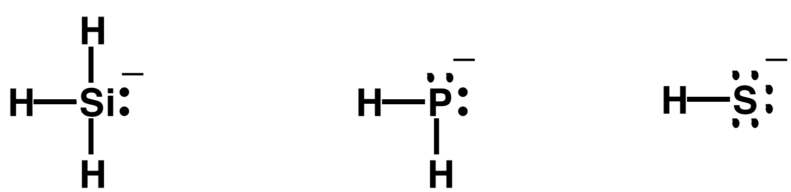
**3.** Identify the most acidic proton(s) on the molecule below. Provide a rationale for your selection. Use pictures as well as words in your explanation.



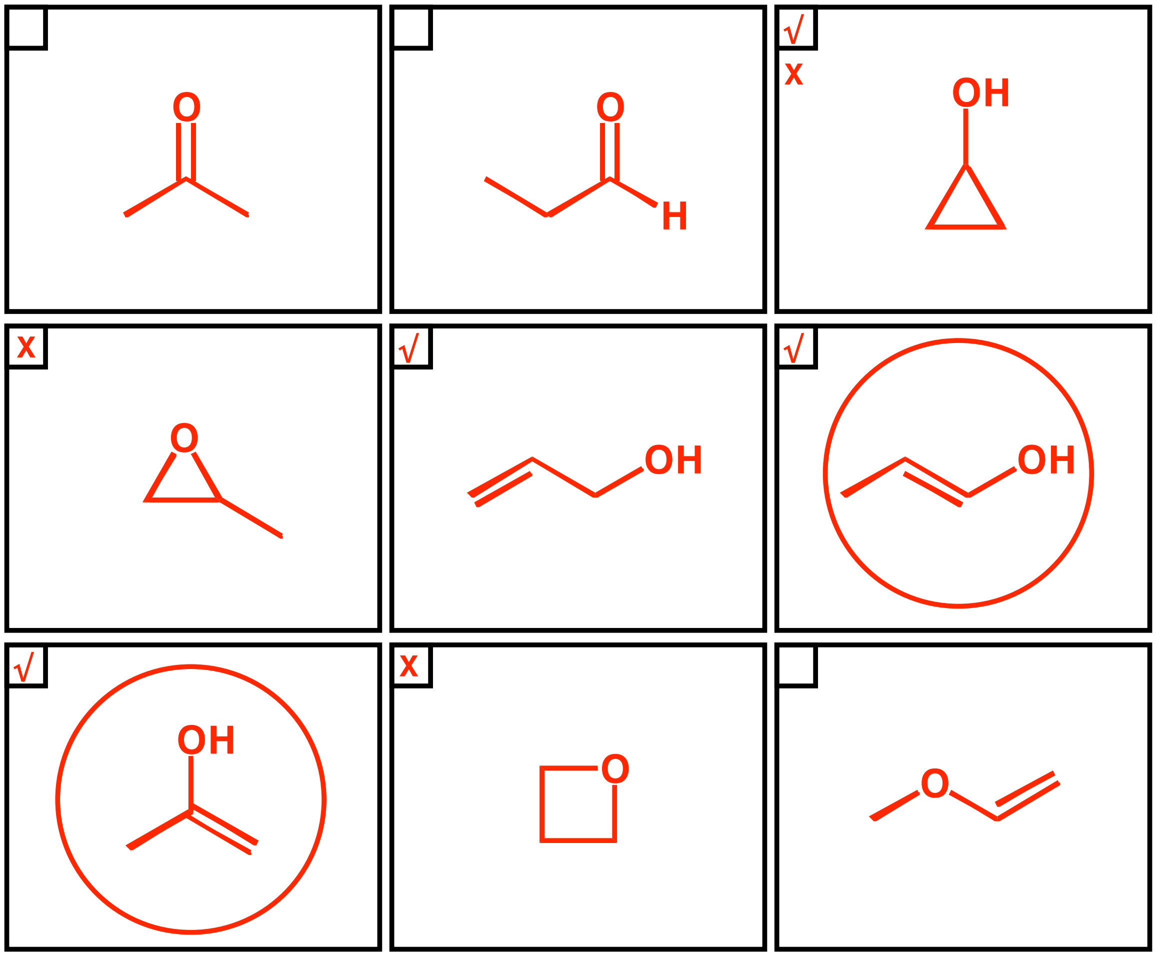
The conjugate base with 3 resonance structures has the most charge delocalization. Spreading the charge to other areas of the molecule makes the conjugate base more stable, thus driving the reaction towards that side of the equilibrium. This, in turn, results in that proton being the most acidic (it is more likely to be abstracted).

**4.** Circle the strongest base from the 3 choices below. Provide a rationale for your selection.



These are bases that differ in their negatively charged atoms. The atoms are part of the same row of the periodic table. Thus, their electronegativities differ drastically. Silicon is the least electronegative and thus the least capable of holding a negative charge. This makes the silicon-containing anion the least stable. The less stable an anion is, the more reactive it is. Since the silicon-containing anion is more reactive, it is the more reactive (stronger) base.

**5.** There are 9 structural isomers for the molecular formula $C_3H_6O$. Draw all 9 isomers in the boxes below. Then answer the questions that follow.



a) Place a *check mark* in the boxes that contain molecules capable of being hydrogen bond donors as well as hydrogen bond acceptors.

**Any molecule with an -OH or -NH bond has H-bond donating and accepting sites**

b) Place an “x” in the boxes that contain molecules that possess angle strain.

**In rings smaller than 6 carbons, the bond angles of sp3 hybridized atoms in the ring are forced to be smaller than 109.5°.**

c) Place a circle in the boxes that contains the two most acidic molecules.

**These two molecules have conjugate bases with the negative charge on the electronegative oxygen atom. Both conjugate bases also have 2 resonance structures.**
Later this semester, we will discuss reasons why one of these two is more acidic. However, from what we know now, they are both of roughly equal acidity.