Background: That first week was pretty full of excitement, wasn't it? I mean, back in general chemistry we called it VSEPR and blamed everything on electron repulsion. Now we have a model that uses hybridized orbitals that does a little better job of describing the shapes of molecules. It is now time for us to start dropping hydrogen.

That is what acids do. They donate hydrogen atoms. To be clear, we are talking about Bronsted-Lowry acids, because there are other kinds of acids. The details this week involve several familiar concepts from second semester general chemistry.

Looking at a balanced chemical equilibrium expression, an acid would be on the reactant side and its conjugate base would be on the product side. If the acid is sufficiently strong, then its conjugate base is weak (that is, stable). This is measured with the acid equilibrium constant (K_a). This number is large when equilibrium favors the products, and small when it favors the reactants. If we take the negative log of Ka, we get the pK_a, which is how most chemists describe acids. The negative log of a small number is a large positive number. So the larger the pKa, the weaker the acid.

When a base is present, to encourage the reaction with the acid, we end up having acids and bases on both sides of the equilibrium. Equilibrium favors the formation of the weakest acid (largest pK_a).

As we will find out, lots of things can influence the value of pKa. This includes hybridization, size, substituents, and resonance. All of these can contribute to the stability of the conjugate base.

Finally, we will look at the interplay between pH and pK_a. When the pH of a solution is lower than the pKa, the solution is more acidic than the acid itself, so the acidic form is favored. When the pH of a solution is higher than the pKa, the solution is less acidic than the acid itself, so the basic form is favored.

There is a lot to keep track, but the Henderson-Hasselbalch equation will be there to help you out, like an old friend.

Outcomes: Upon successful completion of the week, students should be able to:

1. Define acidity for Bronsted-Lowry acids.
2. Define and approximate pK_a values for various chemical groups.
3. Predict the equilibrium state of an acid base reaction based on pK_a values.
4. Describe the factors that influence the acidity of a compound.
5. Describe the interplay between pH and pK_a.

Recommended Problems:

2.53, 2.60, 2.61, 2.68, 2.70, 2.76