pH and pKa

What does pKa tell you?

- pKa tells you if a given molecule is going to either give a proton to water at a certain pH, or remove a proton
- A pKa of 2 for substance "*X*" means that at a pH of 2, *X* is at its equilibrium point.
- If the pH falls to 1, then *X* will accept a proton because there are so darn many available (pH 1 means very acidic—lots of protons) and form *XH*
- If the pH rises to 3, then *X* will give up a proton and exist as X^-
- *At any pH above 2, X is a stable negative ion*
- *So X is a fairly strong acid*

pKa of bases

- Now consider substance "*Y*"
- Y has a pKa of 13, so at any pH less than 13, Y will accept protons and form *YH*
- If the pH rises above 13, then Y will be deprotonated and exist in a stable form as Y^-
- *Y will remove protons at a pH greater than that of neutral water, so Y is a base*

pH versus pKa

- pH tells you about the solution, it says how many free Hydrogen ions are available in a solution, and that's it
- pKa is more specific, it tells you how a certain molecule will react when in a solution that is at a specific pH
- **important misconception** pH depends on how much H+ you have, not what gave you those H+ ions, you can have a stronger acid from vinegar than HCl by using different concentrations of each

What does all this mean?

- An acid gives up protons in solution
- A base removes protons from solution
- The pKa tells you what the pH has to be in order for something to give/take a proton
- Some things we call acids (like ammonium) do donate protons, but the solution must be a base for them to do so-they only give us an acidic pH when we have them in high concentrations (relative to their conjugates)