Ka, Kb

Comparing the pH of two acids

1. Predict the pH of HCl and HF (below)
2. Calibrate a pH meter
3. Measure the pH of HCl(aq) and HF(aq)
4. Complete the chart below

	HCl (aq)	HF (aq)
[ ] in mol/L (on label)		
Net ionic equation		
Predicted $[H^+]$		
Predicted pH		
pH measured		
Actual $[H^+]$		
Conductivity (demo)	Higher / stronger	Lower / weaker

Questions

Read15.3. (pg. 607+)

1. Based on your results, which acid ionizes (forms ions) to a greater degree?
2. Which two measurements taken in the lab support your answer to 1?
3. What is another name for Ka?
4. Solve PE 5, 6
5. Write the Ka equation for HCl (aq) and HF (aq) from today's lab
6. Solve for PE 8, 9 (use this equilibrium for butyric acid: $HBu \leftrightarrow H^+ + Bu^-$)
7. For HF(aq) set up a RICE chart, then solve for Ka. How does your value for Ka compare to the accepted value (pg. 608)?
8. Try PE 10 (follow example 15.7 on pg. 610)

Ka summary

- Ka follows the pattern of other "K" equations
- I.e. for $HA(aq) + H_2O(l) \leftrightarrow H_3O^+(aq) + A^-(aq)$
- $Ka = [H_3O^+][A^-] / [HA]$
- Notice that H_2O is ignored because it is liquid
- HA cannot be ignored because it is aqueous
- This is different than with Ksp. In Ksp, solids could only be in solution as ions
- Acids can be in solution whether ionized or not
- The solubility of acids makes sense if you think back to the partial charges in HCl for ex.

Ka summary

- Generally Ka tells you about acid strength
- Strong acids have high Ka values
- A "strong" acid is an acid that completely ionizes. E.g. $HCl + H_2O \rightarrow H_3O^+ + Cl^-$
- A "weak" acid is an acid that doesn't ionize completely. E.g. $HF + H_2O \leftrightarrow H_3O^+ + F^-$
- Note: don't get confused between strength and concentration. 1 M HCN has a **smaller** $[H^+]$, thus a higher pH, than 0.001 M HCl
- In general:
  - $Ka < 10^{-3}$ Weak acid
  - $10^{-3} < Ka < 1$ Moderate acid
  - $Ka > 1$ Strong acid

Dissociation vs. Ionization

- Ionization and dissociation indicate ions form
- Dissociation: ions form when a chemical comes apart. E.g. NaCl melts to form Na^+, Cl^-
- Ionization: ions form when two chemicals react. E.g. $HCl(aq) + H_2O \leftrightarrow H_3O^+(aq) + Cl^-(aq)$
- Even though we write $HCl \leftrightarrow H^+ + Cl^-$, this is just an abbreviation. In reality HCl reacts with H_2O, thus it is an ionization not a dissociation
- Note that NaCl can also dissociate in water. This is not an ionization, since water is only required to stabilize ions (it is not needed as a *reactant* involved in forming ions)

Kb – the last K (I promise)

- Kb is similar to Ka except b stands for base
- The general reaction involving a base can be written as $B(aq) + H_2O \leftrightarrow BH^+(aq) + OH^-(aq)$
- Thus $Kb = [BH^+] [OH^-] / [B]$
- Recall: shorthand for Ka is $HA \leftrightarrow H^+ + A^-$
- Kb has no shorthand form
- Read pg. 614 - 617
- Try PE 12 (a-c), 13, 14 (for 13, you do not need to know the chemical formula of morphine. Symbolize it with M)