Properties of acids and bases

- Get 8 test tubes. Rinse all tubes well with water. Add acid to four tubes, base to the other four.
- Touch a drop of base to your finger. Record the feel in the chart (on the next slide). Wash your hands with water. Repeat for acid.
- Use a stirring rod, add base to the litmus and pH papers (for pH paper use a colour key to find a number). Record results. Repeat for acid.
- Into the four base tubes add: a) two drops of phenolphthalein, b) 2 drops of bromothymol, c) a piece of Mg, d) a small scoop of baking soda. Record results. Repeat for acid.
- Clean up (wash tubes, pH/litmus paper in trash).

Observations

	NaOH(aq)	HCl(aq)
Taste	Bitter	Sour
Feel (choose slippery or not slippery)		
pH (# from the key)		
Litmus (blue or red)		
Phenolphthalein		
Bromothymol		
Magnesium		
Baking soda		

pH

- There are many ways to consider acids and bases. One of these is pH. Read pg. 368-70.
- $[H^+]$ is critical in many chemical reactions.
- A quick method of denoting $[H^+]$ is via pH.
- By definition **$pH = -\log [H^+]$, $[H^+] = 10^{-pH}$**
- The pH scale, similar to the Richter scale, describes a wide range of values
- An earthquake of "6" is 10× as violent as a "5"
- Thus, the pH scale condenses possible values of $[H^+]$ to a 14 point scale (fig. 2, p370)
- Also, it is easier to say pH=7 vs. $[H^+]=1\times10^{-7}$

Calculations with pH

Q: What is the pH if $[H^+]= 6.3 \times 10^{-5}$?

$pH = -\log [H^+]$

('6.3', 'exp' or 'EE', '5', '+/-', 'log', '+/-')

('-', 'log', '6.3', 'exp' or 'EE', '-', '5')

Q: What is the $[H^+]$ if pH = 7.4?

$[H^+] = 10^{-pH}$ mol/L

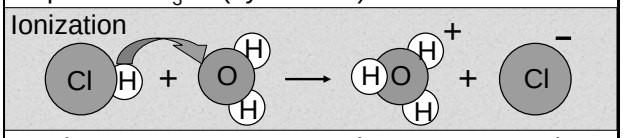
('10', 'x^y', '7.4', '+/-', '=')

('10', '^', '-', '7.4', '=')

Try questions 2 and 6 (a-b) on page 375

Historical views on acids

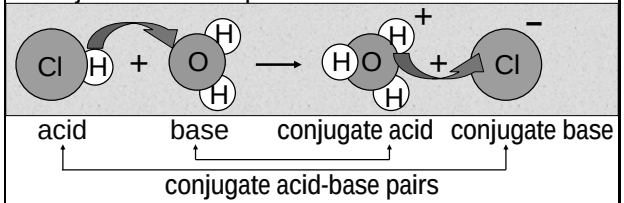
- O (e.g. H_2SO_4) was originally thought to cause acidic properties. Later, H was implicated, but it was still not clear why CH_4 was neutral.
- Arrhenius made the revolutionary suggestion that some solutions contain ions & that acids produce H_3O^+ (hydronium) ions in solution.



- The more recent Bronsted-Lowry concept is that acids are H^+ (proton) donors and bases are proton acceptors

The Bronsted-Lowry concept

- In this idea, the ionization of an acid by water is just one example of an acid-base reaction.



- Acids and bases are identified based on whether they donate or accept H^+.
- "Conjugate" acids and bases are found on the products side of the equation. A conjugate base is the same as the starting acid minus H^+.

Practice problems

Identify the acid, base, conjugate acid, conjugate base, and conjugate acid-base pairs:

$HC_2H_3O_2(aq) + H_2O(l) \rightarrow C_2H_3O_2^-(aq) + H_3O^+(aq)$

$OH^-(aq) + HCO_3^-(aq) \rightarrow CO_3^{2-}(aq) + H_2O(l)$

- Reference: pg. 386 – 387
- Try Q18 (p389), Q 8 & 11 (p392): do as above