Chapter 10

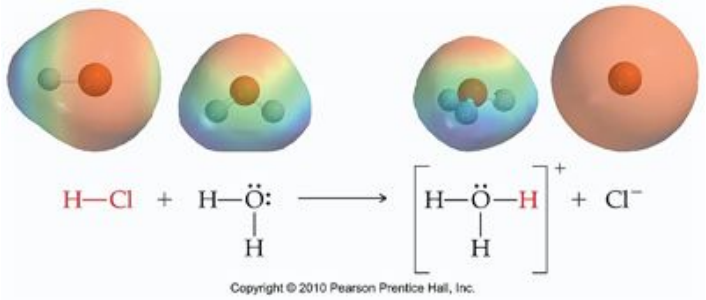
Goals:

- ✓ Be able to recognize an acid and a base, and be able to write a neutralizaiton reaction (you learned this in Chapter 6).
- ✓ Be able to write an equation to show ionization of strong and weak acids and the weak base ammonia.
- ✓ Memorize the strong acids and strong bases, and know that all others are weak.
- ✓ Understand the pH scale, and be able to relate pH to hydronium ion concentration.
- ✓ Know the components of a buffer and how they work to maintain the pH of a buffer solution.

Acid Vs Base

Characteristics of Acids:

- Sour taste
- Produce hydronium ions (H_3O^+) when dissolved in water by donation of H^+
- Acids produce positively and negatively charged ions in aqueous solution; thus acidic solutions conduct electricity and are **electrolytes!**



Characteristics of Bases:

- Bitter taste
- Produce hydroxide ions (OH^-) when dissolved in water by accepting H^+
- Bases produce positively and negatively charged ions in aqueous solution; thus basic solutions conduct electricity and are **electrolytes!**

Strong Vs Weak

Strong acids and bases will completely dissociate in water.

Strong Acids:

- HCl
- HBr
- HI
- HNO_3
- H_2SO_4
- $HClO_4$

Strong Bases:

- Group IA and IIA metal hydroxides

Some substances can behave as either an acid or a base, depending on the circumstances, and are called amphoteric substances.

Recall that an acid and a metal hydroxide base will react in a neutralization reaction to form a salt and water.

pH Scale

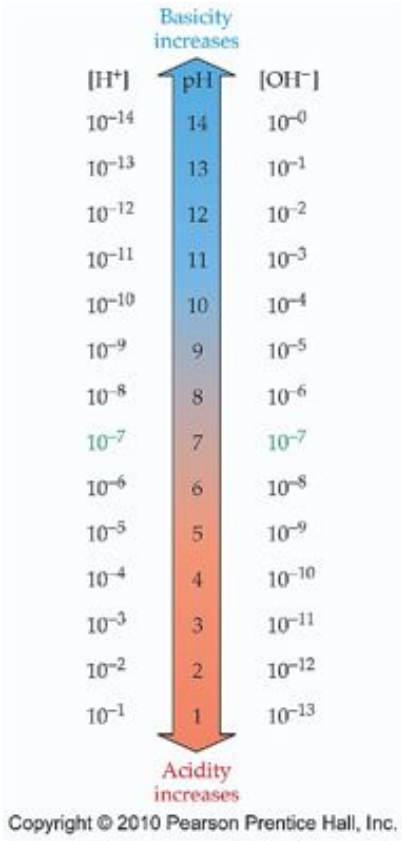
- The pH of a solution is a measure of the H_3O^+ concentration in moles/L (M).
- If the hydronium ion concentration is known, the pH can be found from:

$$pH = - \log [H_3O^+]$$

- Note that the hydronium ion concentration is just the acid concentration for any strong acid since strong acids 100% dissociate in aqueous solution.
- If the pH is known, the hydronium ion concentration can be found from:

$$[H_3O^+] = 10^{-pH}$$

- Since pH is a log scale, a one unit increase in pH is a 10 fold decrease in the $[H_3O^+]$ concentration
- A one unit decrease in pH is a 10 fold increase in the $[H_3O^+]$ concentration.



Problems:

1. A common window-cleaning solution has a $[H3O^+]$ of 5.3×10^{-9} M. What is the pH?

2. Fresh, homemade apple juice was found to have a pH of 3.76. What is the $[H_3O^+]$?

Buffers

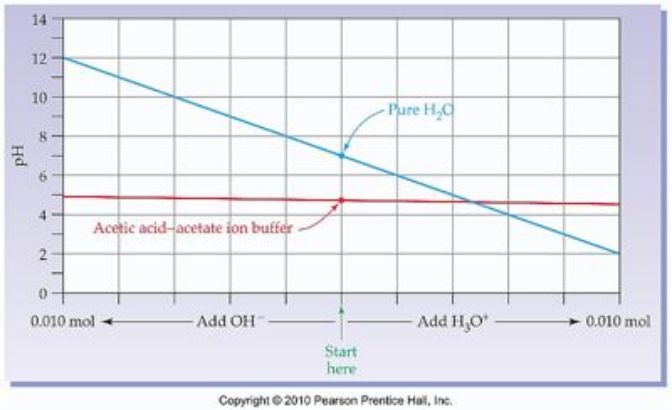
Buffer: A solution that resists a change in pH when a moderate amount of acid or base is added.

A buffer can only work if there is both a weak acid and it's conjugate base present in solution.

In a conjugate acid-base pair the acid will always contain one H more than it's conjugate base.

Examples:

- $HC_2H_3O_2/NaC_2H_3O_2$
- H_3PO_4/NaH_2PO_4



Chapter 10 Problems

Problems:

1. When phosphoric acid and sodium dihydrogen phosphate are mixed in aqueous solution, what molecules and ions are present? Identify the conjugate acid-base pair.

2. When sodium dihydrogen phosphate and potassium hydrogen phosphate are mixed in aqueous solution, what moecules and ions are present? Identify the conjugate acid-base pair.

3. Based on your answers from #1 and 2, which of these substances must be amphoteric?

4. Which of the following could NOT be used to make a buffer?
   a. Nitric acid and sodium nitrate
   b. Acetic acid and calcium acetate
   c. Potassium phosphate and sodium hydrogen phosphate