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Chapter 19: **Acids, Bases, and Salts**

<u>Vocab</u>

Acid: a compound that produces hydrogen ions in a solution
Base: a compound that produces hydroxide (OH^-) ions in a solution
Hydronium Ion: the positive ion formed when a water molecule gains a hydrogen ion
Conjugate Acid: the particle formed when a base gains a hydrogen ion
Conjugate Base: the particle that remains when an acid has donated a hydrogen ion
Conjugate Acid-Base Pair: two substances that are related by the loss or gain of a single hydrogen ion
Amphoteric: a substance that can act as both an acid and a base; most commonly water
Neutral Solution: an aqueous solution in which the concentration of hydrogen and hydroxide ions are equal
Acidic Solution: any solution in which the hydrogen ion concentration is greater than the hydroxide ion concentration
Basic Solution: any solution in which the hydroxide ion concentration is greater than the hydrogen ion concentration
pH: a number used to denote the hydrogen ion concentration, or acidity, in a solution; it is the negative logarithm of the hydrogen ion concentration of a solution
Strong Acid: an acid that is completely (or almost completely) ionized in an aqueous solution
Weak Acid: an acid that is only slightly ionized in an aqueous solution
Strong Base: a base that completely dissociates into metal ions and hydroxide ions in an aqueous solution
Weak Base: a base that reacts with water to form the hydroxide ion and the conjugate acid of the base
Acid Dissociation Constant (Ka): the ratio of the concentration of the dissociated form of an acid to the undissociated form; stronger acids have larger Ka values that weaker acids

Neutralization Reaction: a reaction in which an acid and a base react in an aqueous solution to produce a salt and water; example: HCl + NaOH ----> H_2O + NaCl
Titration: process used to determine the concentration of a solution in which a solution of known concentration is added to a measured amount of the solution of unknown concentration until an indicator signals the end point
Standard Solution: a solution of known concentration used in carrying out a titration
Equivalence Point: the point in a titration where the number of moles of hydrogen ions equals the number of moles of hydroxide ions
End Point: the point in a titration at which the indicator changes color
Salt Hydrolysis: a process in which the cations or anions of a dissociated salt accept hydrogen ions from water or donate hydrogen ions to water

<u>Types of Acids and Bases</u>

- **Arrhenius acid** is any substance that produces H^+ as the only positive ion
- **Brünsten - Lowry acid** is any substance that donates a proton to another molecule
- **Lewis Acid** is an electron donor

- **Arrhenius base** is any substance that produces OH^- as the only negative species
- **Brünsten - Lowry base** is any substance that accepts a proton
- **Lewis base** is a substance that accepts electrons

<u>Self - Ionization of Water</u>
- the reaction in which two water molecules react to produce ions; example: H_2O ----> H+ + OH-

Ion-product constant for water (Ksp): the product of the concentrations of hydrogen ions and hydroxide ions in water
- in a neutral solution: [H+]=[OH-]
- in an acidic solution: [H+]>[OH-]
- in a basic solution: [OH-]>[H+]

- ultimately, Ksp = [H+][OH-]= 1.0 X 10^-14

The pH Scale

- calculating pH from [H+]
    - pH = -log[H+]

- calculating [H+] from pH
    - if the pH is 9.0, then the [H+] is 1 x 10^{-9} M, and so on

- calculating pH from [OH-]
    - recall that the ion-product constant for water defines the relationship between [H+] and [OH-]. Therefore, you can use the ion-product constant for water to determine [H+] from a known [OH-]. Then, use [H+] to calculate the pH.
        - example: $K_w = [OH^-] \times [H^+]$

$$[H^+] = \frac{K_w}{[OH^-]}$$

$$[H^+] = \frac{1.0 \times 10^{-14}}{4.0 \times 10^{-11}} = 0.25 \times 10^{-3} M$$

$$= 2.5 \times 10^{-4} M$$

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

$$= -\log (2.5 \times 10^{-4})$$

- if pH equals 7, neutral solution
- if pH is over 7 to 14, basic solution
- if pH is under 7 to 0, acidic solution