

Chemistry Notes 9/30/13

Arrhenius Definition

- Acid: Substance that produces H^+ ions in water
- Base: Substance that produces OH^- ions in water

Bronsted-Lowry Definition

- Acid: A proton (H^+) donor
- Base: A proton acceptor

pH Scale

- How acidic a solution is depends on the concentration of H^+ ions (or H_3O^+ ions)
 - $H^+ + H_2O \rightarrow H_3O^+$
- $[H^+]$
 - Brackets signify molar concentration
 - A solution with $[H^+] = 1 \times 10^{-4}M$ is more acidic than a solution with $[H^+] = 1 \times 10^{-6}M$
- $pH = -\log[H^+]$
 - What is the pH of a solution with $[H^+] = 1 \times 10^{-4}M$?
 - $pH = -\log[1 \times 10^{-4}] = 4$
 - $pH = -\log[1 \times 10^{-6}] = 6$
 - A lower pH is more acidic because it has a **higher** concentration of H^+ ions
 - $pH < 7 =$ Acidic
 - $pH = 7 =$ Neutral
 - $pH > 7 =$ Base
 - What is the pH of lemon juice with an $[H^+] = 2.5 \times 10^{-3}M$?
 - Somewhere between 2 & 3...
 - $-\log(2.5 \times 10^{-3}) = 2.60$
 - What is the pH of Ammonia if the $[H^+] = 5.3 \times 10^{-12}M$?
 - $-\log(5.3 \times 10^{-12}) = 11.28$
 - What is the $[H^+]$ in a lake whose pH is 4.5?
 - $4.5 = -\log(X)$
 - $10^{-4.5} = X$
 - $[H^+] = X = 3 \times 10^{-5}M$
 - What is the $[H^+]$ of blood with a pH = 7.40?
 - $7.40 = -\log(X)$
 - $X = 10^{-7.4}$
 - $X = [H^+] = 4.0 \times 10^{-8}M$
 - What is the pH of $1 \times 10^{-3}M$ HCl if $[H^+] = 1 \times 10^{-3}M$?
 - HCl is in water, and there is a VERY LITTLE concentration of it
 - Therefore, the pH is ~7
 - $HCl_{(aq)} + NaOH_{(aq)} \rightarrow H_2O + ???$
 - $HCl_{(aq)} + NaOH_{(aq)} \rightarrow H_2O + Na^+Cl^-$
 - Strong Acid + Strong Base \rightarrow Water + Salt (ionic)

- Net ionic equation: $\text{H}^+ + \text{Cl}^- + \text{Na}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{Na}^+ + \text{Cl}^-$
- o $\text{HF}_{(\text{aq})} + \text{NaOH}_{(\text{aq})} \rightarrow \text{H}_2\text{O}_{(\text{l})} + \text{NaF}_{(\text{aq})}$
 - Do not dissociate weak bases/acids (HF)
 - $\text{HF} + \text{Na}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O} + \text{Na}^+ + \text{F}^-$

Example

1. A 25.0 mL sample of hydrochloric acid is titrated with 0.125M $\text{Ba}(\text{OH})_2$. If 50.0mL of the $\text{Ba}(\text{OH})_2$ is required to neutralize, what is the molar concentration of the acid?
 - a. $2\text{HCl} + \text{Ba}(\text{OH})_2 \rightarrow 2\text{H}_2\text{O} + \text{BaCl}_2$
 - b. $?M/25.0\text{mL} + 0.125M/50.0\text{mL}$
 - c. $.125 = \text{mol}/.05$
 - d. $\text{Mol} = .00625\text{mol Ba}(\text{OH})_2$
 - e. $.00625 * 2 = .0125\text{mol HCl}$
 - f. $0.0125/.025 = .5M \text{ HCl}$