Acids an Bases Part 2

Bronstead's and Lowry's Definition of Acids and Bases

Acids are substances which donate protons. Bases are substances which accept protons.

Example

$$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$$

Example

$$NH_3 + H_2O \rightarrow NH_4^+ + OH^-$$

BASE ↑ Accepted proton

ACID ↑ Donated proton

Conjugate Acids and Bases

- **Conjugate Acid - Base Pairs - When** using the Bronsted concept for acids and bases, consider all acid - base reactions as reversible equilibria.

Example

$$NH_3 + H_2O \rightleftarrows NH_4^+ + OH^-$$

BASE ACID

Example

$$NH_3 + H_2O \rightleftarrows NH_4^+ + OH^-$$

NH_3	H_2O	NH_4^+	OH^-
BASE	ACID	CONJUGATE ACID	CONJUGATE BASE

Example

$$NH_3 + H_2O \rightleftharpoons NH_4^+ + OH^-$$

NH_3	H_2O	NH_4^+	OH^-
BASE	ACID	CONJUGATE ACID	CONJUGATE BASE

A base is always paired with a conjugate acid. An acid is always paired with a conjugate base.

Example

$$HF + H_2O \rightarrow F^- + H_3O^+$$

Example

$HF + H_2O \rightarrow F^- + H_3O^+$

HF		H_2O		F^-		H_3O^+
ACID	+	BASE	→	CONJUGATE BASE	+	CONJUGATE ACID

Challenge Questions

* $Al(OH)_3 + 3\ HCl \rightarrow AlCl_3 + 3\ H_2O$
* $2\ HC_2H_3O_2 + Ba(OH)_2 \rightarrow 2\ H_2O + Ba(C_2H_3O_2)_2$
* $2\ KOH + H_2SO_4 \rightarrow K_2SO_4 + 2\ H_2O$

Example

* $Al(OH)_3 + 3\ HCl \rightarrow AlCl_3 + 3\ H_2O$
  BASE ACID CB CA

* $2\ HC_2H_3O_2 + Ba(OH)_2 \rightarrow 2\ H_2O + Ba(C_2H_3O_2)_2$
  ACID BASE CA CB

* $2\ KOH + H_2SO_4 \rightarrow K_2SO_4 + 2\ H_2O$
  BASE ACID CB CA

pH Scale

pH Scale

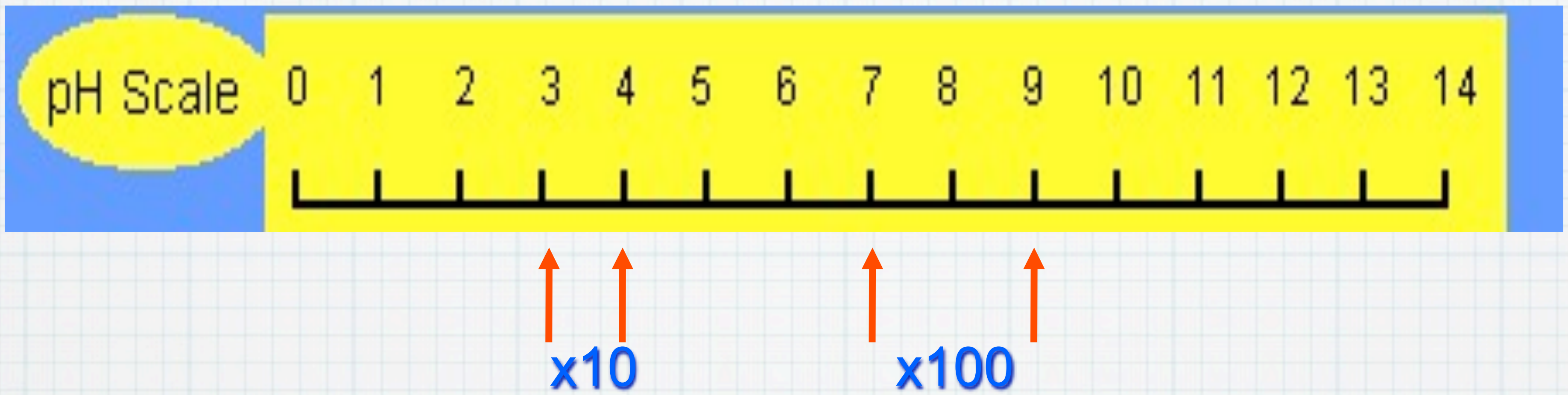
* pH of a solution is a measure of its hydronium ion concentration.
* "p" stands for potential and "H" stands for hydrogen; hence, the potential of a substance to attract hydrogen ions

pH Scale

* The pH scale is a number scale from 0 to 14 to describe the concentration of hydronium ions in a solution.
  * A pH of 7 indicates a neutral solution.
  * Acids have a pH less than 7.
  * Bases have a pH greater than 7.

- If you add an acid to water, the concentration of H30+ increases and the concentration of OH- decreases.
- The lower the pH value, the greater the H_3O^+ ion concentration in solution is.

* If you add a base to water, the concentration of OH^- increases and the concentration of H_3O^+ decreases.
* **The higher the pH value, the lower the H_3O^+ ion concentration is.**



- Each pH unit is *10 times* as large as the previous one
- A change of 2 pH units means *100 times* more basic or acidic

Calculating pH

* $[H_3O^+] = 10^{-pH}$
  * $pH = -\log[H_3O^+]$
* $[OH^-] = 10^{-pOH}$
  * $pOH = -\log[OH^-]$

Type of Indicator	Colour in Acid	Colour in Base
Phenol Red	Yellow	Red
Bromothymol Blue	Yellow	Blue
Blue Litmus Paper	Red	Stays Blue
Red Litmus Paper	Stays Red	Blue
Phenolphthalein	Colourless	Red