# Acids and Bases

## Definitions: Acid & Base, Conjugate Acid & Conjugate Base

- An *acid* donates protons (*i.e.*, Hydrogen ions) in a reaction

- A *base* accepts protons (*i.e.*, Hydrogen ions) in a reaction

- A *conjugate base* results from removing a single $H^+$ from an acid.

    $H_2SO_4$ (acid) → $HSO_4^-$ (conjugate base)

- A *conjugate acid* results from adding a single $H^+$ to a base.

    $H_2O$ (base) → $H_3O^+$ (conjugate acid)

> **Other Definitions**
>
> The definitions of acid and base at left are the Brønsted-Lowry definition; there are two others:
>
> *Arrhenius*
>
> - Acids ionize to form $H^+$ ions
>
> - Bases dissociate to form $OH^-$ ions
>
> *Lewis*
>
> - Acids gain an electron pair
>
> - Bases lose an electron pair

## Concentration, pH, pOH

### pH, pOH

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

- $pOH = -\log[OH^-]$

- $pH + pOH = 14$

### [H⁺], [OH⁻]

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

- $[OH^-] = 10^{-pOH}$

- $[H^+][OH^-] = 10^{-14}$

*Neutral Solution*

In a neutral solution:   $[H^+] = 1 \times 10^{-7}$     $[OH^-] = 1 \times 10^{-7}$     $pH = 7$     $pOH = 7$

*pH of Acids & Bases*

**Acids: pH < 7**          **Bases: pH > 7**          **Neutral: pH = 7**

## Neutralization

- Moles $H^+$ from acid = moles $OH^-$ from base.

    $c_a V_a = c_b V_b$

    $c_a, c_b$ - *Concentrations of acid and base in any units;* $V_a V_b$ - *Volumes of acid and base in any units*

## Strong Acids and Bases

### Acids

| | |
|---|---|
| HCl | $H_2SO_4$ |
| HI | $HClO_3$ |
| $HNO_3$ | $HClO_4$ |
| HBr | |

### Bases

| | |
|---|---|
| LiOH | CsOH |
| NaOH | $Ca(OH)_2$ |
| KOH | $Sr(OH)_2$ |
| RbOH | $Ba(OH)_2$ |