

## Acids, Bases and Salts

### Chapter 23

## Section 23.1: Acids and Bases

### acid

- substance that produces hydrogen ions in a water solution ( $H^+ \rightarrow$  hydrogen ion)
- usually start with an H
  - HCl,  $H_2SO_4$ , HBr,  $HClO_2$ ,  $HNO_3$ ,  $H_3PO_4$
- exception  $\rightarrow CH_3CO_2H$  (acetic acid)

- hydronium ion  $H_3O^+$  forms as a result of H and  $H_2O$  combining

## Properties of Acids

- tastes sour
- corrosive (burns)  $\rightarrow$  strong acids
- acids react with **indicators** and change color
- some acids react strong with metals and form **hydrogen gas**

$$Zn(s) + 2HCl(aq) \rightarrow H_2(g) + ZnCl_2(aq)$$

### indicator

- organic compound that changes color in acids and bases
- red cabbage
- Examples
  - Phenolphthalein
    - colorless when **acidic**; pink when **basic**
  - Litmus Paper
    - red when **acidic**; blue when **basic**

### bases

- substance that forms hydroxide ions in a water solution and accept  $H^+$  ions from acids
- usually end with an OH
  - NaOH,  $Ca(OH)_2$ ,  $Ca(OH)_2$ , KOH
- exception  $\rightarrow NH_3$  (ammonia)
- $OH^- \rightarrow$  hydroxide ion

## Properties of Bases

- slippery
- bitter tasting
- corrosive  $\rightarrow$  strong bases
- some bases react with **indicators** and change color

## Common Acids and Bases

- Acids
  - Citric acid - fruits
  - Sulfuric acid - batteries
  - hydrochloric acid - belly
  - acetic acid - vinegar
  - Carbonic acid - club soda
- Bases
  - ammonia
  - Cleaners
  - baking Soda
  - magnesium hydroxide - antacids

## Neutralization

- a **salt** is a compound formed when the negative ions from an acid combine with the positive ions from a base

- Example



## Solutions of Acids and Bases

- the acid dissociates—or separates—into ions
- the hydrogen atom combines with a water molecule to form hydronium ions ( $\text{H}_3\text{O}^+$ )

- the base dissociates into a positive ion and a negative ion—a hydroxide ion ( $\text{OH}^-$ )
- during base dissociation, water molecules do not combine with the ions formed

## Ammonia

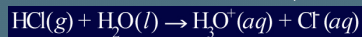
- Ammonia is a base that does not contain OH
- the ammonia molecule attracts a hydrogen ion from a water molecule, forming an ammonium ion ( $\text{NH}_4^+$ )
- this leaves a hydroxide ion ( $\text{OH}^-$ )

## Electrolytes

- Acids and bases are electrolytes.
  - Why?????
  - They form ions when they dissolve in water.
  - Strong acids/bases are better electrolytes than weak acids/bases.

## Section 23.2: Strength of Acids and Bases

- a **strong acid** dissociates almost completely into ions \* low pH closer to 0



- a **weak acid** is one where only a small fraction of the molecules dissolve \* pH closer to 7



- a **strong base** dissociates completely in solution \* pH closer to 14



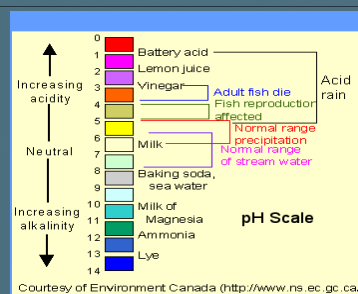
- a **weak base** is one that does not dissociate completely \* pH closer to 7



## pH scale

## pH

- pH measures how **acidic** or **basic** a substance is
- a scale ranging from 0 to 14 has been devised
- based on a log system of base 10
  - 1 times the base logarithm of the  $\text{H}_3\text{O}^+$  concentration
- each one unit change in pH represents a 10 fold change in the concentration of  $\text{H}_3\text{O}^+$  ions
- pH drops from 4 to 3 means the concentration of  $\text{H}_3\text{O}^+$  ions increase by a factor of 10 – from  $10^{-4}$  to  $10^{-3}$



## pH

- Acidic**
  - below pH of 7
  - the lower the pH, the more  $\text{H}^+$  ions in solution
- Base**
  - above pH of 7
  - the higher the pH, the more  $\text{OH}^-$  ions in solution
- Salt**
  - about pH of 7