

# ACIDS AND BASES

## ACIDS:

1. taste sweet or sour
2. changes blue litmus paper red
3. all acids have  $H^+$  ions or hydronium ( $H_3O^+$ )
4. corrosive to metals
5. neutralize bases

ex: sulfuric acid (batteries), HCl (gastric juice), acetic acid (vinegar)

## BASES:

1. taste bitter
2. changes red litmus paper blue
3. all bases have  $OH^-$  ions
4. neutralize acids
5. slippery

ex: ammonium hydroxide (oven cleaner), magnesium hydroxide (MOM), sodium hypochlorite (bleach)

HOW DO YOU ID AN ACID OR BASE?

## Indicators:

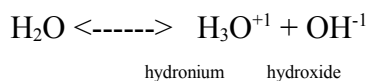
1. litmus paper (hydrion paper)
2. natural - red cabbage, rose petals, etc.
3. weak organic acids:  
phenolphthalein (phth) - substance that turns a solution pink (base) or colorless(acid).

pH scale: used to measure pH (range 0-14)

HOW DO ACIDS AND BASES FORM?

## Hydrogen Ions from water -

Reaction in which 2 water molecules give ions is SELF IONIZATION.  
(Water molecules are in constant motion even at room T)



$[H_3O^+]$  has a shortcut  $\rightarrow [H^+]$

In pure water  $[H^+] = [OH^-]$  There concentrations both are  $1 \times 10^{-7} M$

They are *inversely proportional* to each other.

$K_w$  (ion-product constant for water)

$K_w$  always =  $1 \times 10^{-14} M$  when water dissociates.

$$K_w = \frac{[H^+] \times [OH^-]}{[H_2O]} \quad \text{equilibrium expression}$$

## pH concept

$[H^{+1}]$  in M is cumbersome, so pH scale is used.

$$pH = -\log [H^{+1}]$$

pH = 0  
(very acidic)

pH = 7  
(neutral)

pH = 14  
(very alkaline or basic)

## **BRONSTED-LOWRY ACIDS AND BASES**

Theory - written by two Englishmen (Bronsted and Lowry)

Defined as: acid -  $H^{+1}$  ion donor

base -  $H^{+1}$  ion acceptor

conjugate acid (CA)- particle formed when a base accepts a  $H^{+1}$  ion.

conjugate base (CB) - particle that remains when an acid has donated the base (CB) - particle that remains when an acid has donated the  $H^{+1}$  ion.

Conjugate acid-base pair: related by acceptance or donation of a single  $H^{+1}$  ion.

**bronsted-lowry acid/conjugate base**

**bronsted-lowry base/conjugate acid**

amphoteric - ex. water

-acts as an acid and base

## STRENGTHS OF ACIDS AND BASES

strong acid/base - completely dissociates in solution

weak acid/base - slightly dissociates in solution

$K_a$  = fraction of acid that is ionized

weak  $K_a$  = small  $K_a$  ( weak acid )

strong  $K_a$  = large  $K_a$  ( strong acid )

$K_b$  = fraction of base that is ionized.

weak  $K_b$  --> small  $K_b$

strong  $K_b$  --> large  $K_b$