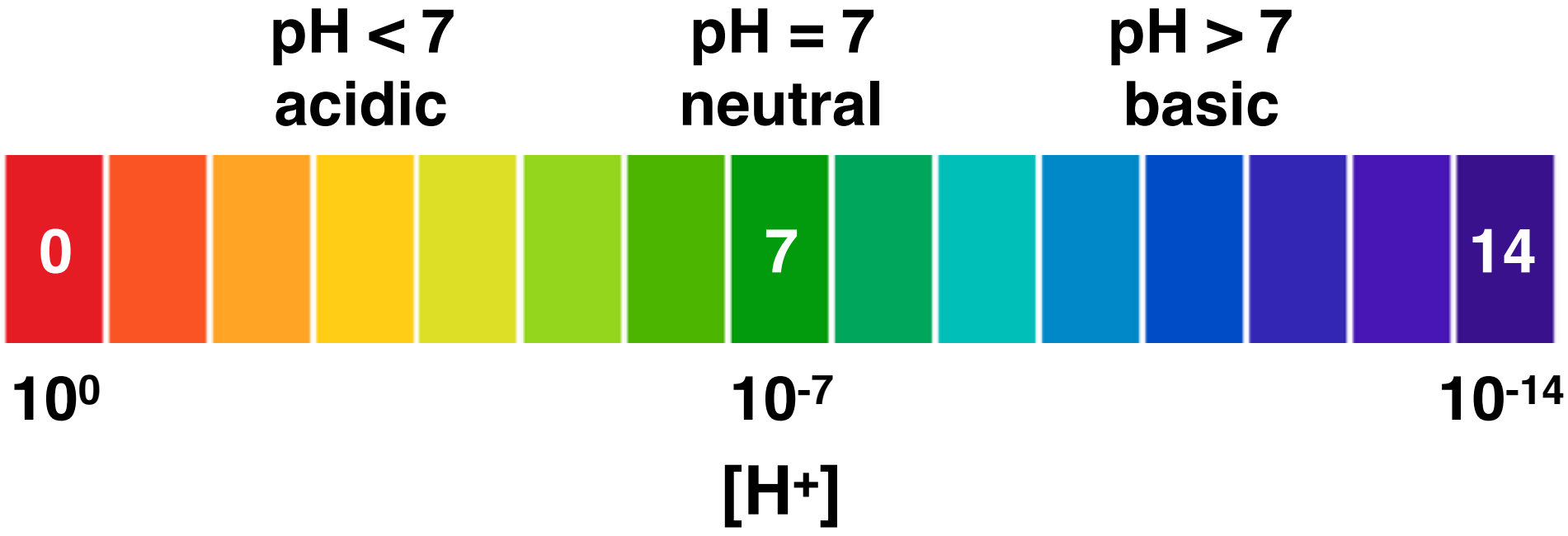
Unit 10: Acids and Bases

Properties of Acids and Bases

Acids	Bases
• **Corrosive** • **Taste sour** • **Reacts with more active metals** • **Affects the color of acid-base indicators** • **Ionize in water** • **Electrolyte**	• **Slippery feel (soap)** • **Taste bitter** • **Affects the color of acid-base indicators** • **Ionize in water** • **Electrolyte**

pH Scale (power of hydrogen)

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



A change of **1** pH unit represents a change by a factor of **10** in the hydrogen ion concentration $[H^+]$.

Acid-Base Indicators

Indicators: organic compounds used to determine the approximate pH of a solution.

common indicators	Acids	Bases
litmus	red	blue
phenolphthalein	colorless	pink

How do we define acids and bases?

There are a few different definitions…

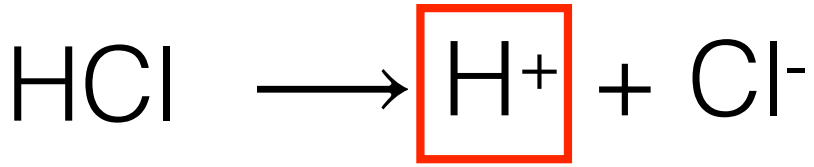
The Arrhenius Theory

An **Arrhenius acid** contains H^+ ions which are liberated when dissolved in water.

An **Arrhenius base** contains OH^- ions which are liberated when dissolved in water.

Strong Acid

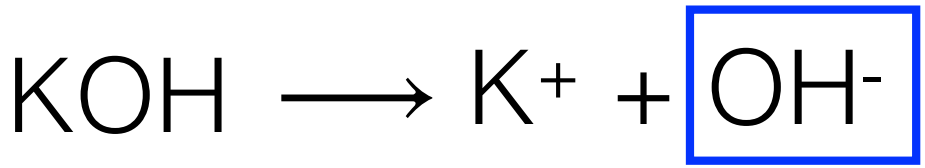
An acid that will 100% ionize (dissociate) in water.



*Note: Most acids are weak acids (*partially* ionize).
Organic acids that contain -COOH are weak acids.

Strong Base

A base that will 100% ionize (dissociate) in water.



Notable Strong Acids:

HCl **HBr** **HI**

HNO_3 **$HClO_4$** **H_2SO_4**

Notable Strong Bases:

$NaOH$ **KOH** **$RbOH$**

$Ca(OH)_2$ **$Ba(OH)_2$** **$Sr(OH)_2$**

How does ammonia react with water?

To be completed in class!
(leave 2-3 lines)

The Brønsted-Lowry Theory

A Brønsted-Lowry acid is a proton donor.

A Brønsted-Lowry base is a proton acceptor.

Conjugate Acid-Base Pairs

In a Brønsted-Lowry acid-base reaction, a proton is transferred from an acid to a base. This reaction forms conjugate acid-base pairs.

Conjugate acid-base pairs differ by one proton (H^+).

Ex. HNO_3 and NO_3^-

Acid-Base Reactions

To be completed in class!
(leave 2 lines above)

$$HCO_3^-(aq) + S^{2-}(aq) \rightleftharpoons HS^-(aq) + CO_3^{2-}(aq)$$

To be completed in class!
(leave 4 lines below)

Let's consider two acid-base reactions:
Connect and label the acid (A), base (B), conjugate acid (CA), and conjugate base (CB).

leave 1 line

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

leave 2 lines

$$CH_3COOH + H_2O \rightleftharpoons H_3O^+ + CH_3COO^-$$

leave 3 lines

Practice

1. Identify the conjugate bases of the following acids:
   a) H_2SO_4
   b) OH^-

To be completed in class!

2. Identify the conjugate acids of the following bases:
   a) HNO_3
   b) OH^-

3. Connect and label the conjugate acid-base pairs in the following equation:

$$CH_3COOH + HPO_4^{2-} \rightleftharpoons CH_3COO^- + H_2PO_4^-$$