Chapter 23.4
Acids, Bases, and pH

What is pH?

- Scale (powers of 10) based on concentration of H^+ ions in solution
- **ACIDIC** is 0 - 6
- **BASIC** is 8 - 14
- **NEUTRAL** is 7

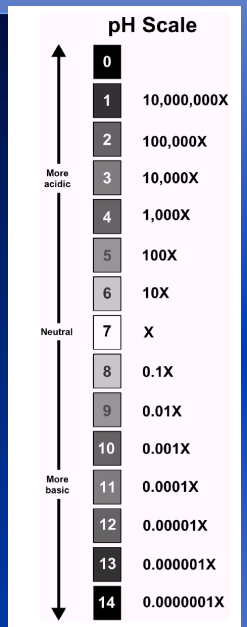


Figure 25.2: *The pH scale is based on the concentration of hydrogen ions in solution.*

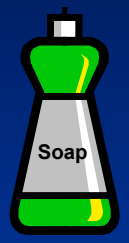
Low pH means *high* H^+ ion concentration

- **Acids** - chemicals that release H^+ ions in a solution.
- So…acids produce more H^+ ions (lower pH).

Properties of Acids

- Low pH – 0 to 6
- Sour taste
- Cause indicators to change color (Ex: turns litmus red)
- Corrosive
- Reacts with metals
- Electrolytes

Bases are chemicals that release OH^- ions in a solution.



- So…bases produce more OH^- ions *and* *less H^+ ions* (higher pH)

Properties of Bases

- High pH – 8 to 14
- Bitter taste
- Feels slippery
- Causes indicators to change color (Ex: turns litmus blue)
- Corrosive
- Reacts with fats

How do these pH values compare?

- pH <7 means $[H^+] > [OH^-]$
- pH >7 means $[H^+] < [OH^-]$
- pH = 7 means $[H^+] = [OH^-]$

Why is pH important?

- pH of drinking water indicates its quality.
  - pH too high, pipes clog
  - pH too low, pipes corrode

- pH important to life
  - pH of natural bodies of water has to be right (pH 6-8) for fish and other aquatic animals and plants to reproduce.
  - Lower pH and they die!

- pH plays important role in digestion.

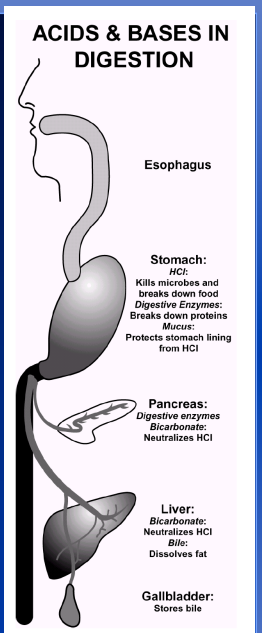


Figure 25.1: *Acids and bases play important roles in digestion.*

- Acids (low pH) used throughout industry… fertilizer, soft drinks, batteries, etching metals & glass.

- Bases (high pH) unclog drains; used as cleaners, soaps, shampoos.

Strong vs weak acids and bases

- Strong acids and bases dissociate (break apart into ions) almost completely in water.
- Weak acids and bases dissociate (ionize) incompletely in water.

Concentrated vs dilute acids and bases

- Concentrated – little water in the solution and lots of acid / base molecules.
- Dilute – lots of water in the solution and few acid / base molecules.

What happens when you mix an acid and a base?

- Mixing equal parts of an acid and base together, results in a solution made of water and a salt. It is neutral (pH = 7, $[H^+] = [OH^-]$)
- They neutralize each other!

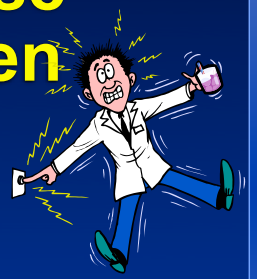
Examples:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

strong acid + strong base → salt + water

$$H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$$

All acids and bases are electrolytes because they form ions when dissolved.



- **Electrolytes** – ions which allow a solution to conduct electricity when dissolved in water.

Non-electrolytes

- Chemicals that do not form ions when they are dissolved in solution.
- Example: sugar in water

What is acid rain?

- Any rain, snow, hail, sleet, fog with pH < 5.6
- Harmful to plants, animals, people, buildings