Chapter 6-1

- Matter: anything that has mass and volume
  - element: simplest form of matter made up of one kind of element: the smallest particle is the atom
  - compound: 2 or more elements joined chemically in a certain ratio; the smallest particle is the molecule
  - mixture; 2 or more substances (elements or compounds or both) joined physically
- Types of mixtures

	Characteristics	**Particle Size**	**Separation Method**	**Example**
Suspension	Settle out	Can be seen	Filtration Settling	Water and pepper flakes
Colloid	-Don't settle out -Undissolved	-Smaller than suspension -Large enough to scatter light		Jello, mayo, shaving cream, whipped cream
Solution	-Solute: the substance that is dissolved in another Solvent: the dissolver -Well-mixed; don't settle out; pass through filter paper - Water is the universal solvent	Smallest	Evaporation Boiling	Sugar in water, salt in water, air, blood, saliva, alloys, ocean water

- When a solution forms, particles of solute leave each other and become surrounded by particles of solvent.
  - ionic solids in water: the opposite charges are attracted to the polar water and become surrounded by water. Ex. salt/water
  - molecular solids in water: individual neutral molecules that are slightly polar will be attracted to the polar water and become surrounded by water. Ex. sugar/water
- Effects of solutes on solutions:

- Lower freezing point of a solvent
  When water freezes, the molecules stop moving about, instead they form crystals of ice. When you add salt (solute) to the water (solvent), the salt particles will be in the way making it harder for the water to form crystals. The freezing point drops.
- Increase the boiling point of solvent
  When a liquid evaporates, molecules from its surface leave the liquid and enter the sir above. When the temperature is high enough, gas bubbles form within the liquid and the liquid boils. When you add salt (solute), less water (solvent) molecules are exposed to the surface to escape into the air. The boiling point goes higher.
- Technology connection: the coolant in a car radiator is a solution of water (solvent) and a liquid called antifreeze (solute). The solute lowers the freezing point of the solution and therefore reduces the risk of freezing in cold weather. The solute also increases the boiling point of the solution and therefore reduces the risk of overheating in hot weather.

Chapter 6-2

- Dilute Solution: little solute in the same amount of solvent
  Concentrated solution: more solute in the same amount of solvent

- Change concentration by adding more solute or removing/adding solvent

- Measure concentration by comparing the amount (either mass or volume) of solute to the amount (either mass or volume) of solvent or total solution
  Represent concentration as % in solution
  Ex. volume of solution = 473.0 milliliters; 70% alcohol
  volume of alcohol (solute) = 473.0 x 70% = 331.1 milliliters

- Solubility: measure of how well a solute can dissolve in a solvent at a given temperature. It is a characteristic property of a substance.

- Saturated solution has as much solute as possible at a given temperature
  Unsaturated solution doesn't have as much solute as possible at a given temperature

- Changing solubility

  1. For most solids, solubility increases as temperature increases.
     Supersaturated solution has more solute that is predicted by its solubility at a given temperature. If you disturb it, the extra solute will come out.
     For gases, solubility decreases as temperature increases.
     Ex. if you open a warm soda can, the carbon dioxide gas escapes in greater amounts than when it is chilled.

2. For gases, the solubility increases as pressure increases.
   Ex. the gas in soft drinks is added under pressure; when you open the can, the gas escapes as pressure is released.
   Ex. scuba divers breathe from tanks of compressed air. The nitrogen gas dissolves in their blood in greater amounts as they descend. If they return too quickly, nitrogen bubbles come out of solution and block blood flow and cause pain.

3. Ionic and polar compounds dissolve well in polar solvents. Non-polar compounds will not.
   Ex. water-based paint is cleaned with soap and water, whereas oil-based paint should be cleaned with non-polar solvents.
   Ex. vitamins A, D, E, K are fat-soluble and can be stored in the body. Vitamins B and C are water-soluble and come out of the body quickly. Too much of a vitamin can be as harmful as too little.

Chapter 6-3

- Acid: a substance that
  - tastes sour; not good for identifying
  - reacts with metals to produce hydrogen gas; the metal seems to disappear
  - reacts with carbonates to produce carbon dioxide gas; ex. limestone (calcium carbonate) reacts with hydrochloric acid
  - reacts with indicators, ex. changes blue litmus paper into red

- Base: a substance that
  - tastes bitter; not good for identifying
  - feels slippery; not good for identifying
  - reacts with indicators, ex. changes red litmus paper into blue
  - doesn't react with carbonates

* See pages 195-6 for uses of acids and bases.

Chapter 6-4

- An acid produces H^+ ions in water which give the acid its characteristic properties:

- A base produces OH^- ions in water which give the base its characteristic properties:

- Strong acid: produces more H^+ ions compared to the same concentration of the weaker one
  Strong base: produces more OH^- ions compared to the same concentration of the weaker one
  The strength determines how safe the acid or base is.
  Do not confuse dilute with weak; dilute has less solute in the same amount of solvent as the concentrated one.
- pH
  - describes the concentration of the H^+ ions and tells if the substance is acidic or basic
  - pH scale ranges between 0 and 14; 0 being a very strong acid (high H^+), 7 being neutral, and 14 being a very strong base (low H^+)
  - You can find pH by using indicators.
  - A concentrated solution of a weak acid like acetic acid can have a lower pH than a very dilute solution of a strong acid like hydrochloric acid. So, in order to handle acids and bases safely we need to know not only its concentration but the pH as well.
  - Regular rain has a ph of 5.5 because of the carbon dioxide in the air mixes with water and produces a weak acid called carbonic acid. Acid rain has a pH of 3.5-3.0 because nitrogen and sulfur oxides from pollutants react with water in the air and produce strong acids like nitric and sulfuric acids.
- Acid-Base Reactions
  - An acid reacts with a base producing salt and water; both products have pH of 7 (neutral); the reaction is known as Neutralization Reaction.

  - The final pH depends on many factors such as volume, concentration, and type of reactants. A very small amount of a strong base with a large amount of a strong acid may result in an acidic solution.

Chapter 6-5

- Digestion: breaks down food into simpler substances that your body can use for raw materials and energy
- Mechanical digestion: physically breaks down large pieces of food into smaller ones
- Chemical digestion: changes large molecules into smaller ones with the help of enzymes (biological catalysts)
- Digestion in the body:

Organ	Enzyme	pH	Function
Mouth	Amylase in saliva	7	Changes carbohydrates into sugars
Stomach	Pepsin with the help of hydrochloric acid (HCl)	2	Changes proteins into amino acids
Small Intestine	Bicarbonate ion (HCO_3^-)	8	Completes the breakdown of fats, proteins, and carbohydrates