Chapter 5-1

- Evidence of chemical reactions:
    1. Changes in properties resulting in a new substance
       Ex. gas bubbles; color change; precipitate (solid forming out of a solution)
    2. Changes in energy
        - energy is either absorbed or released when matter changes
        - one indicator is change in temperature
            a. endothermic reactions absorb energy; temperature decreases; ex. cold pack
            b. exothermic reactions release energy; temperature increases; ex. fuel burning

- Chemical changes involve rearrangement of atoms: bonds broken and new ones made.

- The properties of the new substance are determined by the type of atoms and the type of chemical bonds.

- The type of bond will also determine if the chemical reaction will happen under certain circumstances.
  Ex. some bonds in glass are very strong and hard to change. Wood frames around the glass might rot since wood is made of compounds that react easily with other substances in the environment such as water and fungi.

Chapter 5-2

- Writing the chemical formula of a compound
  - using symbols to identify the elements
  - using subscripts to show the ratio of the elements in the compound
- Chemical equation is a shorter way to show the chemical reaction. It involves reactants (starting substances) and products (ending substances). The arrow means yield.
- Classification of chemical equations:
  - synthesis: when two or more substances (elements or compounds) combine to make a more complex substance
  - decomposition: when compounds are broken down into simpler products
  - replacement: when one element replaces another in a compound or when two elements in different compounds trade places
- Balancing the chemical equations using coefficients:
  a. the amount of matter in a chemical equation does not change
  b. total mass of the reactants equals the total mass of the products
  c. this is called conservation of mass (matter is not created not destroyed)

Chapter 5-3

- Chemical reactions need a certain amount of energy to get started so that the existing bonds are broken or new ones formed. The minimum amount of energy needed to start a chemical reaction is called its activation energy.
  Ex. for the reaction between hydrogen gas and oxygen gas to produce water, a tiny amount of activation energy-just a spark-is needed.

- Whether a reaction also needs energy to keep going depends on whether it is exothermic or endothermic (see the graphs on page 162).
  a. Exothermic reactions:
  - additional energy is not needed to complete the reaction
  - energy is given off as the reaction takes place
  - the energy level of the products is lower than that of the reactants

  b. Endothermic reactions:
  - an additional supply of energy is needed to keep the reaction going
  - the materials absorb energy
  - the energy level of the products is higher than that of the reactants

- A reaction's speed depends partly on how easily the particles of the reactants can get together. The following can control the rate of a reaction:
  - concentration: amount of one material in a given amount of another. By increasing the concentration, more particles react, the reaction is faster.
  - Temperature: the average kinetic energy of the moving particles. As the temperature increases, the particles move faster, the particles come in contact more often or have more energy, the reaction is faster.
  - Surface area: by breaking a solid into smaller pieces, its surface area is increased, more particles are exposed, the reaction is faster.
  - Catalyst: a material that lowers the activation energy without itself being changed or becoming a reactant. By adding a catalyst, less activation energy is required, the reaction is faster. Enzymes are biological catalysts that help body reactions, such as digestion, happen at lower and safer temperatures.
  - Inhibitor: a material that decreases the rate of a reaction. Ex. adding wood pulp to nitroglycerin, a powerful liquid explosive, will absorb the liquid and keep it from reacting until ignited. This way it can be handled more safely.

Chapter 5-4

- Combustion: a rapid exothermic reaction between oxygen gas and fuel releasing carbon dioxide gas, water, and sometimes also smoke and poisonous gases if the burning is incomplete or impurities are present.
- The Fire Triangle:
    - fuel: material that releases energy when it burns, ex. oil, natural gas, wood, coal, paper, gasoline
    - oxygen: from the air; cooler denser air replaces warmer less denser air and brings fresh supply of oxygen
    - heat: provides the activation energy from a lighted match, spark, lightning, stove
- Controlling fire: remove any part of the triangle
    - add water which doesn't let the fuel come in contact with oxygen and also cools the reaction by using the heat to evaporate
    - add baking soda to small kitchen fires; particles in the food will react with it and release carbon dioxide which will not let the fuel to come in contact with oxygen
- Home safety: see pages 170-171
- The best fire safety strategy is fire prevention.