7 Chemical Reactions

7.1 Describing Reactions

- 7.1.1 Interpret chemical equations in terms of reactants, products and conservation of mass.
- 7.1.2 Balance chemical equations by manipulating coefficients.
- 7.1.3 Convert between moles and mass of a substance using molar mass.
- 7.1.4 Calculate amounts of reactants or products using molar mass, mole ratios, and balanced chemical equations.

7.2 Types of Reactions

- 7.2.1 Classify chemical reactions as synthesis, decomposition, single-replacement, double-replacement, or combustion reactions.
- 7.2.2 Describe oxidation-reduction reactions, and relate them to other classifications of chemical reactions.

7.3 Energy Changes in Reactions

- 7.3.1 Describe the energy changes that take place during chemical reactions.
- 7.3.2 Classify chemical reactions as exothermic or endothermic.
- 7.3.3 Explain how energy is conserved during chemical reactions.

7.4 Reaction Rates

- 7.4.1 Explain what a reaction rate is.
- 7.4.2 Describe the factors affecting chemical reaction rates.

7.5 Equilibrium

- 7.5.1 Identify and describe physical and chemical equilibria.
- 7.5.2 Describe the factors affecting chemical equilibrium.
8 Solutions, Acids, and Bases

8.1 Formation of Solutions

- 8.1.1 Describe how a substance can dissolve in water by dissociation, dispersion, or ionization.
- 8.1.2 Describe how the physical properties of a solution can differ from those of its solute and solvent.
- 8.1.3 Identify energy changes that occur during the formation of a solution.
- 8.1.4 Describe factors affecting the rate at which a solute dissolves in a solvent.

8.2 Solubility and Concentration

- 8.2.1 Define solubility and describe factors affecting solubility.
- 8.2.2 Classify solutions as unsaturated, saturated, or supersaturated.
- 8.2.3 Calculate and compare and contrast solution concentrations expressed as percent by volume, percent by mass, and molarity.

8.3 Properties of Acids and Bases

- 8.3.1 Define acid and describe some of the general properties of an acid.
- 8.3.2 Define base and describe some of the general properties of a base.
- 8.3.3 Identify a neutralization reaction, and describe the reactants and products of neutralization.
- 8.3.4 Explain how acids and bases can be defined as proton donors and proton acceptors.

8.4 Strength of Acids and Bases

- 8.4.1 Define pH, and relate pH to hydronium ion concentration in a solution.
- 8.4.2 Distinguish between strong acids and weak acids, and between strong bases and weak bases.
- 8.4.3 Define buffer, and describe how a buffer can be prepared.
- 8.4.4 Explain how electrolytes can be classified.
9 Carbon Chemistry

9.1 Carbon Compounds

- 9.1.1 Relate the structures of three forms of carbon to their properties.
- 9.1.2 Explain why there are millions of different organic compounds.
- 9.1.3 Relate the number and arrangements of carbon atoms in hydrocarbons to their properties.
- 9.1.4 Distinguish unsaturated from saturated hydrocarbons.
- 9.1.5 Classify hydrocarbons using structural formulas and names.
- 9.1.6 Distinguish the formation, composition, and uses of three types of fossil fuels.
- 9.1.7 Distinguish complete combustion from incomplete combustion of fossil fuels.
- 9.1.8 Describe the effects of some products of the combustion of fossil fuels.

9.2 Substituted Hydrocarbons

- 9.2.1 Classify substituted hydrocarbons based on their functional groups.
- 9.2.2 Describe some properties and reactions of five types of substituted hydrocarbons.

9.3 Polymers

- 9.3.1 Distinguish a monomer from a polymer.
- 9.3.2 Compare three examples of synthetic polymers.
- 9.3.3 Describe the structures and functions of four types of natural polymers.

9.4 Reactions in Cells

- 9.4.1 Compare photosynthesis and cellular respiration.
- 9.4.2 Explain how enzymes and vitamins help reactions take place in cells.
10 Nuclear Chemistry

10.1 Radioactivity

- 10.1.1 Describe the process of nuclear decay.
- 10.1.2 Classify nuclear reactions as alpha particles, beta particles, or gamma rays.
- 10.1.3 Balance nuclear equations.
- 10.1.4 Identify sources of nuclear radiation, and describe how nuclear radiation affects matter.
- 10.1.5 Describe methods of detecting nuclear radiation.

10.2 Rates of Nuclear Decay

- 10.2.1 Define half-life, and relate half-life to the age of a radioactive sample.
- 10.2.2 Compare and contrast nuclear reaction rates with chemical reaction rates.
- 10.2.3 Describe how radioisotopes are used to estimate the age of materials.

10.3 Artificial Transmutation

- 10.3.1 Describe and identify examples of transmutation.
- 10.3.2 Describe how transuranium elements are synthesized.
- 10.3.3 Explain how particle accelerators have been used in scientific research.

10.4 Fission and Fusion

- 10.4.1 Compare and contrast nuclear forces.
- 10.4.2 Describe the process of nuclear fission.
- 10.4.3 Explain how nuclear reactors are used to produce energy.
- 10.4.4 Describe the process of nuclear fusion.