aqueous solutions – solutions in which water is the dissolving medium

4.1: General Properties of Aqueous Solutions

• electrolyte – substance whose aqueous solution contains ions
• nonelectrolyte – substance that does not form ions in solution

4.2.1 Ionic Compounds in Water

• dissociate – when ions separate from a solid being dissolved

4.2.2 Molecular Compounds in Water

• the molecular structure is maintained

4.2.3 Strong and Weak Electrolytes

• strong electrolytes – ionic compounds that exist entirely of ions in solution
• weak electrolytes – molecular compounds that produce a small amount of ions
• chemical equilibrium – equilibrium of forming ions and recrystallizing ions

4.2: Precipitation Reactions

\[AX + BY \rightarrow AY + BX\]

• for methathesis to occur:
  1. the formation of an insoluble product
  2. the formation of either a weak electrolyte or a nonelectrolyte
  3. the formation of a gas that escapes from solution

4.5.1 Precipitation Reactions

• precipitate – insoluble solid formed by a reaction in solution
• solubility – amount of substance that can be dissolved in a given quantity

4.5.2 Solubility Guidelines for Ionic Compounds

• all common ionic compounds of the alkali metal ions and of the ammonium ion are soluble in water

4.5.3 Reactions in Which a Weak Electrolyte or Nonelectrolyte Forms

• hydrogen and hydroxide react to form water
• insoluble metal oxides react with acids
4.3: Acid-Base Reactions

4.3.1 Acids

• substances that ionize to form hydrogen ions
• proton donors

4.3.2 Bases

• substances that ionize to form hydroxide ions

4.3.3 Strong and Weak Acids and Bases

• strong acid, strong base – strong electrolyte
• weak acid, weak base – weak electrolyte

4.3.4 Neutralization Reactions and Salts

• neutralization reaction – when an acid and base are mixed
• produces water and a salt

4.4 Ionic Equations

• molecular formula – and equation written to show the complete chemical formulas of reactants and products
• spectator ions – ions that do not play a role in a reaction
• net ionic equation – equation where the spectator ions are removed
• only soluble strong electrolytes are written in ionic form

4.4: Oxidation-Reduction Reactions

4.6.1 Reactions in Which a Gas Forms

• carbonates and bicarbonates

4.6.2 Oxidation and Reduction

• oxidation – loss of electrons
• reduction – gain of electrons

4.6.3 Oxidation of Metals by Acids and Salts

• whenever one substance is oxidized, some other substance must be reduced
• metals react with acids to form salts and hydrogen gas

4.6.4 The Activity Series
• **activity series** – list of metals arranged in order of decreasing ease of oxidation
• **active metals** – alkali metals and alkaline earth metals
• any metal on the list can be oxidized by ions of elements below it

### 4.5: Concentration of Solutions

- **solution** – homogeneous mixture of two or more substances
- **solvent** – component that is present in greatest quantity
- **solutes** – substances dissolved in the solvent

#### 4.1.1 Molarity

- **concentration** – the amount of solute dissolved in a given quantity of solvent or solution
- **molarity** – number of moles of solute in a liter of solution

#### 4.1.2 Dilution

- **dilution** - obtaining a lower concentration of a solution by adding water
  - moles solute before dilution = moles solute after dilution

### 4.6: Solution Stoichiometry and Chemical Analysis

#### 4.7.1 Titrations

- **standard solution** – solution of known concentration
- **titration** – a known solution that undergoes a specific chemical reaction of known stoichiometry with the solution of unknown concentration
- **equivalence point** – stoichiometrically equivalent quantities of reactants are brought together
- **indicator** – used to show the endpoint of the titration