Pearson

Chapter Summary and Review

Key Learning Outcomes

CHAPTER OBJECTIVES	ASSESSMENT
Calculate and Use Molarity as a Conversion Factor (8.2)	• Examples 8.1, 8.2 For Practice 8.1, 8.2 For More Practice 8.1, 8.2 Exercises 21, 22, 23, 24, 25, 26, 27, 28
Determine Solution Dilutions (8.2)	• Example 8.3 For Practice 8.3 For More Practice 8.3 Exercises 29, 30, 31, 32
Use Solution Stoichiometry to Find Volumes and Amounts (8.3)	• Example 8.4 For Practice 8.4 For More Practice 8.4 Exercises 33, 34, 35, 36, 37, 38
Predict Compound Solubility (8.4)	• Example 8.5 For Practice 8.5 Exercises 39, 40, 41, 42
Write Equations for Precipitation Reactions (8.5)	• Examples 8.6, 8.7 For Practice 8.6, 8.7 Exercises 43, 44, 45, 46
Write Complete Ionic and Net Ionic Equations (8.6)	• Example 8.8 For Practice 8.8 For More Practice 8.8 Exercises 47, 48, 49, 50
Name Acids (8.7)	• Examples 8.9, 8.10 For Practice 8.9, 8.10 For More Practice 8.10 Exercises 51, 52, 53, 54
Write Equations for Acid–Base Reactions (8.7)	• Examples 8.11, 8.12 For Practice 8.11, 8.12 Exercises 55, 56, 57, 58, 59, 60
Solve Calculations Involving Acid–Base Titrations (8.7)	• Example 8.13 For Practice 8.13 For More Practice 8.13 Exercises 61, 62
Write Equations for Gas-Evolution Reactions (8.8)	• Example 8.14 For Practice 8.14 For More Practice 8.14 Exercises 63, 64, 65, 66
Assign Oxidation States (8.9)	• Example 8.15 For Practice 8.15 Exercises 67, 68, 69, 70

Identify Redox Reactions, Oxidizing Agents, and Reducing Agents Using Oxidation States (8.9)	• Examples 8.16, 8.17 For Practice 8.16, 8.17 For More Practice 8.16 Exercises 71, 72
Predict the Spontaniety of Redox Reactons (8.9)	• Example 8.18 For Practice 8.18 Exercises 73, 74, 75, 76, 77, 78

Key Terms

Section 8.2

solution
solvent
solute
aqueous solution
dilute solution
concentrated solution
molarity (M)
stock solution

Section 8.4

electrolyte
strong electrolyte
nonelectrolyte
acid
strong acid
weak acid
weak electrolyte
soluble
insoluble

Section 8.5

precipitation reaction
precipitate

Section 8.6

molecular equation
complete ionic equation
spectator ion
net ionic equation

Section 8.7

acid–base reaction (neutralization reaction)
Arrhenius definitions (of acid and bases)
hydronium ion
polyprotic acid
diprotic acid
base

base

binary acid

oxyacid

salt

titration

equivalence point

indicator

Section 8.8

gas-evolution reaction

Section 8.9

oxidation–reduction (redox) reaction

oxidation

reduction

oxidation state (oxidation number)

oxidizing agent

reducing agent

activity series of metals

Key Concepts

Solution Concentration (8.2)

- An aqueous solution is a homogeneous mixture of water (the solvent) with another substance (the solute).
- We often express the concentration of a solution in molarity, the number of moles of solute per liter of solution.

Solution Stoichiometry (8.3)

- We can use the molarities and volumes of reactant solutions to predict the amount of product that will form in an aqueous reaction or the amount of one reactant needed to react with a given amount of another reactant.

Aqueous Solutions and Precipitation Reactions (8.4, 8.5)

- Solutes that completely dissociate (or completely ionize in the case of the strong acids) to ions in solution are strong electrolytes and are good conductors of electricity. Water-soluble ionic compounds, strong acids and strong bases are strong electrolytes.
- Solutes that only partially dissociate (or partially ionize) are weak electrolytes. Weak acids are weak electrolytes.
- Solutes that do not dissociate (or ionize) are nonelectrolytes.
- A substance that dissolves in water to form a solution is soluble.
- The solubility rules are an empirical set of guidelines that help predict the solubilities of ionic compounds; these rules are especially useful when determining whether or not a precipitate forms.
- In a precipitation reaction, we mix two aqueous solutions and a solid—a precipitate—forms.

Equations for Aqueous Reactions (8.6)

- We can represent an aqueous reaction with a molecular equation, which shows the complete neutral formula for each compound in the reaction.
- We can also represent an aqueous reaction with a complete ionic equation, which shows the dissociated nature of the aqueous ionic compounds.
- A third representation of an aqueous reaction is the net ionic equation, in which the spectator ions—those that do not change in the course of the reaction—are left out of the equation.

Acid–Base Reactions (8.7)

- In an acid–base reaction, an acid, a substance that produces H^+ in solution, reacts with a base, a substance that produces OH^- in solution, and the two neutralize each other, producing water (or in some cases a weak electrolyte).
- An acid–base titration is a laboratory procedure in which a reaction is carried to its equivalence point—the point at which the reactants are in exact stoichiometric proportions; titrations are useful in determining the concentrations of unknown solutions.

Gas-Evolution Reactions (8.8)

- In gas-evolution reactions, two aqueous solutions combine and a gas is produced.

Oxidation–Reduction Reactions (8.9)

- In oxidation–reduction reactions, one substance transfers electrons to another substance.
- The substance that loses electrons is oxidized, and the substance that gains electrons is reduced.
- An oxidation state is a fictitious charge given to each atom in a redox reaction by assigning all shared electrons to the atom with the greater attraction for those electrons. Oxidation states are an imposed electronic bookkeeping scheme, not an actual physical state.
- The oxidation state of an atom increases upon oxidation and decreases upon reduction.
- The activity series of metals can be used to predict spontaneous redox reaction. Any half-reaction in the series is spontaneous when paired with any reverse half-reaction below it.

Key Equations and Relationships

Molarity (M): Solution Concentration (8.2)

$$\mathrm{M} = \frac{\text{amount of solute (in mol)}}{\text{volume of solution (in L)}}$$

Solution Dilution (8.2)

$$M_1V_1 = M_2V_2$$

Solution Stoichiometry (8.3)

$$\text{volume A} \rightarrow \text{amount A (in moles)} \rightarrow \text{amount B (in moles)} \rightarrow \text{volume B}$$