

# TABLE OF CONTENTS

## Licensing

## 1: Essential Ideas of Chemistry

- 1.1: Chemistry in Context
- 1.2: Phases and Classification of Matter
- 1.3: Physical and Chemical Properties
- 1.4: Measurements
- 1.5: Measurement Uncertainty, Accuracy, and Precision
- 1.6: Mathematical Treatment of Measurement Results
- 1.E: Essential Ideas of Chemistry (Exercises)

## 2: Atoms, Molecules, and Ions

- 2.1: Prelude to Atoms
- 2.2: Early Ideas in Atomic Theory
- 2.3: Evolution of Atomic Theory
- 2.4: Atomic Structure and Symbolism
- 2.5: Chemical Formulas
- 2.6: The Periodic Table
- 2.7: Molecular and Ionic Compounds
- 2.8: Chemical Nomenclature
- 2.E: Atoms, Molecules, and Ions (Exercises)

## 3: Composition of Substances and Solutions

- 3.1: Formula Mass and the Mole Concept
- 3.2: Determining Empirical and Molecular Formulas
- 3.3: Molarity
- 3.4: Other Units for Solution Concentrations
- 3.E: Composition of Substances and Solutions (Exercises)

## 4: Stoichiometry of Chemical Reactions

- 4.1: Prelude to Stoichiometry
- 4.2: Writing and Balancing Chemical Equations
- 4.3: Classifying Chemical Reactions
- 4.4: Reaction Stoichiometry
- 4.5: Reaction Yields
- 4.6: Quantitative Chemical Analysis
- 4.E: Stoichiometry of Chemical Reactions (Exercises)

## 5: Thermochemistry

- 5.1: Prelude to Thermochemistry
- 5.2: Energy Basics
- 5.3: Calorimetry
- 5.4: Enthalpy
- 5.E: Thermochemistry (Exercises)

## 6: Electronic Structure and Periodic Properties

- 6.1: Electromagnetic Energy
- 6.2: The Bohr Model
- 6.3: Development of Quantum Theory
- 6.4: Electronic Structure of Atoms (Electron Configurations)
- 6.5: Periodic Variations in Element Properties
- 6.E: Electronic Structure and Periodic Properties (Exercises)

## 7: Chemical Bonding and Molecular Geometry

- 7.1: Prelude to Chemical Bonding and Molecular Geometry
- 7.2: Ionic Bonding
- 7.3: Covalent Bonding
- 7.4: Lewis Symbols and Structures
- 7.5: Formal Charges and Resonance
- 7.6: Strengths of Ionic and Covalent Bonds
- 7.7: Molecular Structure and Polarity
- 7.E: Chemical Bonding and Molecular Geometry (Exercises)

## 8: Advanced Theories of Covalent Bonding

- 8.1: Prelude to Covalent Bonding
- 8.2: Valence Bond Theory
- 8.3: Hybrid Atomic Orbitals
- 8.4: Multiple Bonds
- 8.5: Molecular Orbital Theory
- 8.E: Advanced Theories of Covalent Bonding (Exercises)

## 9: Gases

- 9.1: Gas Pressure
- 9.2: Relating Pressure, Volume, Amount, and Temperature - The Ideal Gas Law
- 9.3: Stoichiometry of Gaseous Substances, Mixtures, and Reactions
- 9.4: Effusion and Diffusion of Gases
- 9.5: The Kinetic-Molecular Theory
- 9.6: Non-Ideal Gas Behavior
- 9.E: Gases (Exercises)

## 10: Liquids and Solids

- 10.1: Prelude to Liquids and Solids
- 10.2: Intermolecular Forces
- 10.3: Properties of Liquids
- 10.4: Phase Transitions
- 10.5: Phase Diagrams
- 10.6: The Solid State of Matter
- 10.7: Lattice Structures in Crystalline Solids
- 10.E: Liquids and Solids (Exercises)

## 11: Solutions and Colloids

- 11.1: Prelude to Solutions and Colloids
- 11.2: The Dissolution Process
- 11.3: Electrolytes

- 11.4: Solubility
- 11.5: Colligative Properties
- 11.6: Colloids
- 11.E: Solutions and Colloids (Exercises)

## 12: Kinetics

- 12.1: Prelude to Kinetics
- 12.2: Chemical Reaction Rates
- 12.3: Factors Affecting Reaction Rates
- 12.4: Rate Laws
- 12.5: Integrated Rate Laws
- 12.6: Collision Theory
- 12.7: Reaction Mechanisms
- 12.8: Catalysis
- 12.E: Kinetics (Exercises)

## 13: Fundamental Equilibrium Concepts

- 13.1: Prelude to Equilibrium
- 13.2: Chemical Equilibria
- 13.3: Equilibrium Constants
- 13.4: Shifting Equilibria - Le Chatelier's Principle
- 13.5: Equilibrium Calculations
- 13.E: Fundamental Equilibrium Concepts (Exercises)

## 14: Acid-Base Equilibria

- 14.1: Brønsted-Lowry Acids and Bases
- 14.2: pH and pOH
- 14.3: Relative Strengths of Acids and Bases
- 14.4: Hydrolysis of Salt Solutions
- 14.5: Polyprotic Acids
- 14.6: Buffers
- 14.7: Acid-Base Titrations
- 14.E: Acid-Base Equilibria (Exercises)

## 15: Equilibria of Other Reaction Classes

- 15.1: Precipitation and Dissolution
- 15.2: Lewis Acids and Bases
- 15.3: Coupled Equilibria
- 15.E: Equilibria of Other Reaction Classes (Exercises)

## 16: Thermodynamics

- 16.1: Spontaneity
- 16.2: Entropy
- 16.3: The Second and Third Laws of Thermodynamics
- 16.4: Gibbs Energy
- 16.E: Thermodynamics (Exercises)

## 17: Electrochemistry

- 17.1: Balancing Oxidation-Reduction Reactions
- 17.2: Galvanic Cells
- 17.3: Standard Reduction Potentials
- 17.4: The Nernst Equation
- 17.5: Batteries and Fuel Cells
- 17.6: Corrosion
- 17.7: Electrolysis
- 17.E: Electrochemistry (Exercises)

## 18: Representative Metals, Metalloids, and Nonmetals

- 18.1: Periodicity
- 18.2: Occurrence and Preparation of the Representative Metals
- 18.3: Structure and General Properties of the Metalloids
- 18.4: Structure and General Properties of the Nonmetals
- 18.5: Occurrence, Preparation, and Compounds of Hydrogen
- 18.6: Occurrence, Preparation, and Properties of Carbonates
- 18.7: Occurrence, Preparation, and Properties of Nitrogen
- 18.8: Occurrence, Preparation, and Properties of Phosphorus
- 18.9: Occurrence, Preparation, and Compounds of Oxygen
- 18.10: Occurrence, Preparation, and Properties of Sulfur
- 18.11: Occurrence, Preparation, and Properties of Halogens
- 18.12: Occurrence, Preparation, and Properties of the Noble Gases
- 18.E: Representative Metals, Metalloids, and Nonmetals (Exercises)

## 19: Transition Metals and Coordination Chemistry

- 19.1: Properties of Transition Metals and Their Compounds
- 19.2: Coordination Chemistry of Transition Metals
- 19.3: Optical and Magnetic Properties of Coordination Compounds
- 19.E: Transition Metals and Coordination Chemistry (Exercises)

## 20: Organic Chemistry

- 20.1: Prelude to Organic Chemistry
- 20.2: Hydrocarbons
- 20.3: Alcohols and Ethers
- 20.4: Aldehydes, Ketones, Carboxylic Acids, and Esters
- 20.5: Amines and Amides
- 20.E: Organic Chemistry (Exercises)

## 21: Nuclear Chemistry

- 21.1: Nuclear Structure and Stability
- 21.2: Nuclear Equations
- 21.3: Radioactive Decay
- 21.4: Transmutation and Nuclear Energy
- 21.5: Uses of Radioisotopes
- 21.6: Biological Effects of Radiation
- 21.E: Nuclear Chemistry (Exercises)

## 22: Appendices

- [22.1: Composition of Commercial Acids and Bases](#)
- [22.2: Essential Mathematics](#)
- [22.3: Formation Constants for Complex Ions](#)
- [22.4: Fundamental Physical Constants](#)
- [22.5: Ionization Constants of Weak Acids](#)
- [22.6: Ionization Constants of Weak Bases](#)
- [22.7: Solubility Products](#)
- [22.8: Standard Electrode \(Half-Cell\) Potentials](#)
- [22.9: Standard Thermodynamic Properties for Selected Substances](#)
- [22.10: The Periodic Table](#)
- [22.11: Units and Conversion Factors](#)
- [22.12: Water Properties](#)

[Index](#)

[Glossary](#)

[Detailed Licensing](#)