

# TABLE OF CONTENTS

Licensing

summary

## 1: Chemical Foundations

- 1.1: Chemistry: An Overview
- 1.2: Chemistry Applications
- 1.3: The Scientific Method
- 1.4: Chemistry in Industry
- 1.5: Polymer Chemistry
- Index

## 2: Atoms Molecules and Ions

- 2.1 The Early History of Chemistry
- 2.2 Fundamental Chemical Laws
- 2.3 Dalton's Atomic Theory
- 2.4: Cannizzaro's Interpretation
- 2.5: Early Experiments to Characterize the Atom
- 2.6: Modern Perspective of Atomic Structure
- 2.7: Molecules and Ions
- 2.8: An Introduction to the Periodic Table
- 2.9: Nomenclature of Simple Compounds

## 3: Stoichiometry

- 3.1: Atomic Mass
- 3.2: The Mole
- 3.3: Molar Mass
- 3.4: Problem Solving Exercises
- 3.5 Percent Composition of Compounds
- 3.6 Determining the Formula of a Compound
- 3.7 Chemical Equations
- 3.8 Balancing Chemical Equations
- 3.9 Stoichiometric Calculations: Amounts of Reactants and Products
- 3.10: Calculations Involving a Limiting Reactant
- 3.11: Complex Problem Solving Approaches

## 4: Chemical Reactions

- 4.1: Water, the Universal Solvent
- 4.2: Strong and Weak Electrolytes
- 4.3: The Composition of Solutions
- 4.4: Types of Chemical Reactions
- 4.5: Precipitation Reactions
- 4.6: Reactions in Solution
- 4.7: Selective Precipitation
- 4.8: Stoichiometry of Precipitation Reactions
- 4.9: Acid-Base Reactions

- 4.10: Oxidation-Reduction Reactions
- 4.11: Balancing Redox Equations
- 4.12: Redox Titrations

## 5: Gases

- 5.1: Early Efforts to Understand Gases
- 5.2: The Gas Laws of Boyle, Charles, and Avogadro
- 5.3: The Ideal Gas Law
- 5.4: Gas Stoichiometry
- 5.5: Dalton's Law of Partial Pressures
- 5.6: The Kinetic Molecular Theory of Gases
- 5.7: Effusion and Diffusion
- 5.8: Collisions with Container Walls
- 5.9: Breaking the Ideal Gas Law: Intermolecular Collisions
- 5.10: Real Gases
- 5.11: Characteristics of Several Real Gases
- 5.12: Chemistry in the Atmosphere

## 9: Thermochemistry

- 9.1: The Nature of Energy
- 9.2: Enthalpy
- 9.3: Calorimetry
- 9.5: Hess's Law
- 9.6: Standard Enthalpies of Formation
- 9.7: Present Sources of Energy
- 9.8: New Energy Sources

## 12: Atomic Theory and Quantum Mechanics

- 12.1: Electromagnetic Radiation
- 12.2: The Nature of Matter
- 12.3: The Atomic Spectrum of Hydrogen
- 12.4: The Bohr Model
- 12.5: The Quantum Mechanical Model of the Atom
- 12.6: Particle in a Box
- 12.7: The Wave Equation for the Hydrogen Atom
- 12.8: The Meaning of the Wavefunction
- 12.9: Orbital Shapes and Energies
- 12.10: Electron Spin and the Pauli Principle
- 12.11: Polyelectronic Atoms
- 12.12: The History of the Periodic Table
- 12.13: The Aufbau Principles and the Periodic Table
- 12.14: The Polyelectronic Model
- 12.15: Periodic Trends in Atomic Properties
- 12.16: The Properties of a Group: The Alkali Metals

## 8: Aqueous Solution Equilibria

- 8.1: Solutions of Acids or Bases Containing a Common Ion
- 8.2: Buffered Solutions
- 8.3: Exact Treatment of Buffered Solutions
- 8.4: Buffer Capacity

- 8.5: Titrations and pH Curves
- 8.6: Acid-Base Indicators
- 8.7: Titrations of Polyatomic Acids
- 8.8: Solubility Equilibria and the Solubility Product
- 8.9: Precipitation and Qualitative Analysis Complex Ion Equilibria
- 8.10: Complex Ion Equilibria

## 13: Bonding General Concepts

- 13.1: Types of Chemical Bonds
- 13.2: Electronegativity
- 13.3: Bond Polarity and Dipole Moments
- 13.4: Ions: Electron Configurations and Sizes
- 13.5: Formation of Binary Ionic Compounds
- 13.6: Partial Ionic Character of Covalent Bonds
- 13.7: The Covalent Chemical Bond: A Model
- 13.8: Covalent Bond Energies and Chemical Reactions
- 13.9: The Localized Electron Bonding Model
- 13.10: Lewis Structures
- 13.11: Resonance
- 13.12: Exceptions to the Octet Rule
- 13.13: Molecular Structure: The VSEPR Model

## 14: Covalent Bonding

- 14.1: Hybridization and the Localized Electron Model
- 14.2: The Molecular Orbital Model
- 14.3: Bonding in Homonuclear Diatomic Molecules
- 14.4: Bonding in Heteronuclear Diatomic Molecules
- 14.5: Combining the Localized Electron and Molecular Orbital Models
- 14.6: Orbitals are Human Inventions
- 14.7: Introduction to Molecular Spectroscopy
- 14.8: Electronic Spectroscopy
- 14.9: Vibrational Spectroscopy
- 14.10: Rotational Spectroscopy
- 14.11: Nuclear Magnetic Resonance Spectroscopy

## 10: Entropy, Gibbs Energy, and Spontaneity

- 10.1: Spontaneous Processes
- 10.2: Isothermal Expansions and Compressions of Ideal Gases
- 10.3: Definition of Entropy
- 10.4: Entropy and Physical Changes
- 10.5: Entropy and the Second Law of Thermodynamics
- 10.6: The Effect of Temperature on Spontaneity
- 10.7: Gibbs (Free) Energy
- 10.8: Entropy Changes in Chemical Reactions
- 10.9: Gibbs Energy and Reactions
- 10.10: The Dependence of Free Energy on Pressure
- 10.11: Gibbs Energy and Equilibrium
- 10.12: Free Energy and Work

## 11: Electrochemistry

- 11.1: Galvanic Cells
- 11.2: Standard Reduction Potential
- 11.3: Cell Potential, Electrical Work, and Gibbs Energy
- 11.4: Dependence of Cell Potential on Concentration
- 11.5: Batteries
- 11.6: Corrosion
- 11.7: Electrolysis
- 11.8: Commercial Electrolytic Processes
- Index

## 15: Chemical Kinetics

- 15.1: Reaction Rates
- 15.2 Rate Laws: An Introduction
- 15.3: Determining the Form of the Rate Law
- 15.4: The Integrated Rate Law
- 15.5: Rate Laws: A Summary
- 15.6: Reaction Mechanisms
- 15.7: The Steady-State Approximation
- 15.8: A Model for Chemical Kinetics
- 15.9: Catalysis

## 16: Liquids and Solids

- 16.1: Intermolecular Forces
- 16.2: The Liquid State
- 16.3: An Introduction to Structures and Types of Solids
- 16.4: Structure and Bonding in Metals
- 16.5: Carbon and Silicon: Network Atomic Solids
- 16.6: Molecular Solids
- 16.7: Ionic Solids
- 16.8: Structures of Ionic Solids
- 16.9: Lattice Defects
- 16.10: Vapor Pressure and Changes of State
- 16.11: Phase Diagrams
- 16.12: Nanotechnology
- 16.E: Exercises

## 17: Solutions

- 17.1: Solution Composition
- 17.2: The Energies of Solution Formation
- 17.3: Factors Affecting Solubility
- 17.4: The Vapor Pressures of Solutions
- 17.5: Boiling-Point Elevation and Freezing-Point Depression
- 17.7: Colligative Properties of Electrolyte Solutions
- 17.7: Osmotic Pressure
- 17.8: Colloids

## 18: The Representative Elements

- 18.1: A Survey of the Representative Elements
- 18.2: Group 1A Metals
- 18.3: The Chemistry of Hydrogen
- 18.4: Group 2A Elements
- 18.5: Group 3A Elements
- 18.6: Group 4A Elements
- 18.7: The Group 5A Elements
- 18.8: The Chemistry of Nitrogen
- 18.9: The Chemistry of Phosphorus
- 18.10: The Group 6A Elements
- 18.11: The Chemistry of Oxygen
- 18.12: The Chemistry of Sulfur
- 18.13: The Group 7A Elements
- 18.14: The Group 8A Elements

## 19: Transition Metals and Coordination Chemistry

- 19.1: The Transition Metals: A Survey
- 19.2: The First-Row Transition Metals
- 19.3: Coordination Compounds
- 19.4: Isomerism
- 19.5: Bonding in Complex Ions
- 19.6: The Crystal Field Model
- 19.7: Molecular Orbital Model
- 19.8: The Biologic Importance of Coordination Complexes

## 20: The Nucleus A Chemists View

- 20.1: Nuclear Stability and Radioactive Decay
- 20.2: Radioactive Kinetics
- 20.3: Nuclear Transformations
- 20.4: Detections and Applications of Radioactivity
- 20.5: Thermodynamic Stability of Nuclei
- 20.6: Nuclear Fission and Fusion
- 20.7: Effects of Radiation on Matter

## 21: Organic and Biological Chemistry

- 21.1: Alkanes: Saturated Hydrocarbons
- 21.2: Alkenes and Alkynes
- 21.3: Aromatic Hydrocarbons
- 21.4: Hydrocarbon Derivatives
- 21.5: Polymers
- 21.6: Natural Polymers

## 6: Chemical Equilibrium

- 6.1: The Equilibrium State
- 6.2: Equilibrium Constants
- 6.3: Equilibrium Expressions Involving Pressures
- 6.4: Activity is an Effective Concentration
- 6.5: Heterogeneous Equilibria
- 6.6: Applications of the Equilibrium Constant

- [6.7: Solving Equilibrium Problems](#)
- [6.8: Le Châtelier's Principle](#)
- [6.9: Equilibria of Real Gases](#)

## 7: Acids and Bases

- [7.1: The Nature of Acids and Bases](#)
- [7.2: Acid Strength](#)
- [7.3: The pH Scale](#)
- [7.4: Calculating the pH of Strong Acid Solutions](#)
- [7.5: Calculating the pH of Weak Acid Solutions](#)
- [7.6 Bases](#)
- [7.7: Polyprotic Acids](#)
- [7.8: Acid-Base Properties of Salts](#)
- [7.9: Acid Solutions that Water Contributes pH](#)
- [7.10: Strong Acid Solutions that Water Contributes pH](#)
- [7.11: Approaches to Solve Acid-Base Problems](#)

## 8: Equilibria in Aqueous Solutions

- [16.1 Spontaneous Processes and Entropy](#)
- [16.2 Entropy and the Second Law of Thermodynamics](#)
- [16.3 The Effect of Temperature on Spontaneity](#)
- [16.4 Free Energy](#)
- [16.5 Entropy Changes in Chemical Reactions](#)
- [16.6 Free Energy and Chemical Reactions](#)
- [16.7 The Dependence of Free Energy on Pressure](#)
- [16.8 Free Energy and Equilibrium](#)
- [16.9 Free Energy and Work](#)

[Index](#)

[Glossary](#)

[Detailed Licensing](#)