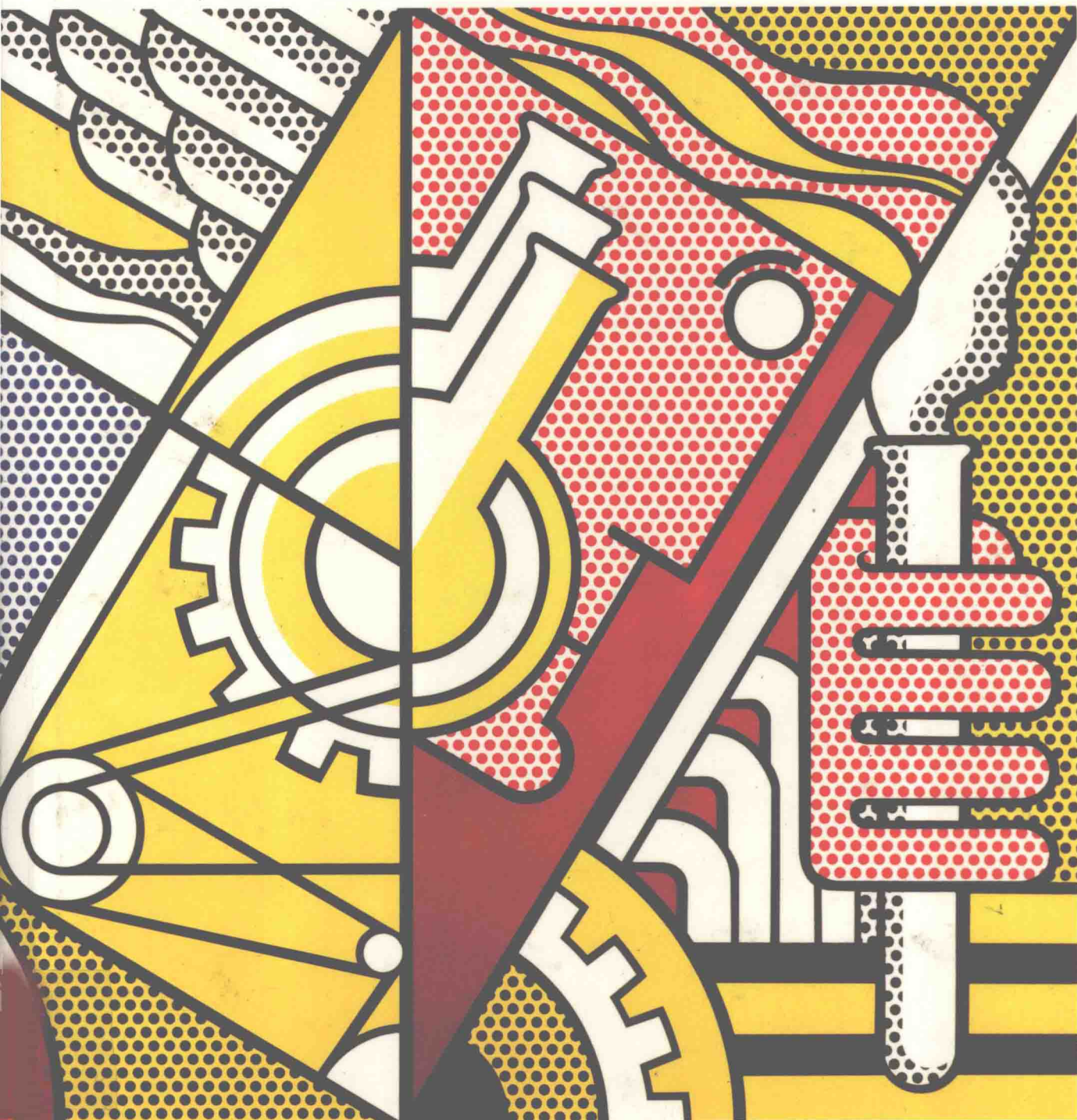


RAYMOND CHANG
ESSENTIAL CHEMISTRY



ESSENTIAL CHEMISTRY

RAYMOND CHANG

Williams College

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About the Author

Raymond Chang was born in Hong Kong and grew up in Shanghai, China, and Hong Kong. He received his B.Sc. degree in chemistry from London University, England, and his Ph.D. in chemistry from Yale University. After doing postdoctoral research at Washington University and teaching for a year at Hunter College, he joined the chemistry department at Williams College, where he has taught since 1968. Professor Chang has written books on spectroscopy, physical chemistry, and industrial chemistry and has coauthored books on the Chinese language, a novel for juvenile readers, and children's picture books.

For relaxation, Professor Chang maintains a forest garden, plays tennis, and practices the violin.

PREFACE

With a few simple images, the painting that is reproduced on the cover of this book—titled *Peace Through Chemistry*—captures the essence of chemistry. This art by Roy Lichtenstein serves as a colorful metaphor for this text, which presents only the material that is essential for a one-year general chemistry course. I do not presume to have created a masterpiece, but I offer this text as an alternative to the traditional 1100-page volumes for instructors who want to be able to cover every chapter in two semesters or three quarters.

My goal in writing this book was to include all the core topics that are necessary for a good foundation in general chemistry without sacrificing clarity and comprehension. Doing so in a brief form required a certain amount of selectivity. The selection process involved asking myself each time I started a new chapter, “What is essential for students to know about this area of chemistry?” Although some people may not agree totally with my choices, I feel that this approach has resulted in a book that students and instructors alike will be comfortable with.

ORGANIZATION

The organization of this text is fairly conventional and flexible. Chapters 1 to 12 follow the normal sequence for easy coordination with lab work. Organic chemistry and polymer chemistry, two topics that usually come at the end of a general chemistry text, are presented here in Chapters 13 and 14. This placement allows the use of organic compounds as examples and in problems for subsequent chapters and exposes students to the chemistry of natural and synthetic polymers. However, these chapters can be covered later in the course with no breaks in continuity. Chemical kinetics (Chapter 21) also can be introduced in a more traditional sequence, just before or after Chapter 15.

There are no discrete chapters on descriptive chemistry in this book because most instructors lack the time necessary for an extensive survey of the chemistry of the periodic groups. Instead, descriptive chemistry is integrated throughout the text to show how chemical principles are applied in the real world. Chapters 2, 3, 4, 8, and 18, in particular, have a descriptive orientation, and many of the examples and chapter problems include descriptive material.

Each chapter opens with a short historical vignette or contemporary story that is relevant to the subject of the chapter. By emphasizing chemistry as a human endeavor, the fruits of which are all around us, these introductions provide a real context for chemistry. I hope they will also stimulate the reader's interest in the content that follows.

Within the chapter, verbal explanations of concepts, theory, and mathematical relationships are reinforced with text and pictorial illustrations, worked examples, and practice exercises. A chapter summary and key words list are provided to help students review the chapter. Review questions and follow-up problems conclude each chapter.

PROBLEM-SOLVING APPROACH

The ability to analyze and solve problems is crucial for the successful completion of general chemistry. Consequently, this text includes 161 examples with full solutions to show how to approach the type of problem described in the example heading. The placement of these examples within the text demonstrates problem-solving strategies in context and the similar practice exercise that follows each example allows students to check their general understanding of the chemical concepts and principles discussed in the text while applying them to a specific question. Answers to the practice exercises appear at the end of a chapter.

Review questions and problems at the end of each chapter provide additional opportunities for concept review and practice in problem solving. The review questions check students' understanding of the conceptual side—the “why” of chemistry. The 880 problems cover the quantitative, experimental side of chemistry that yields numerical results. They explore “how” chemistry works and test the ability to apply conceptual logic and solve problems. The review questions and problems are grouped in sections that parallel the chapter discussion, and each problem is paired with another similar problem for additional practice. A set of “Miscellaneous Problems” at the end of the exercise section features more challenging problems as well as problems involving two or more concepts. These give students experience in identifying concepts and techniques needed to solve real problems. The answers to all even-numbered problems are provided in the back of the book.

SUPPLEMENTS

A number of excellent ancillary publications are available for use with this text. They are designed to make general chemistry more enjoyable for instructors and students alike.

- **Problem-Solving Workbook with Solutions**, by Brandon Cruickshank (Northern Arizona University) and Raymond Chang, is a success guide written for use with *Essential Chemistry*. It aims to help students hone their analytical and problem-solving skills by presenting detailed discus-

sion of different types of problems and approaches to solving chemical problems, tutorial solutions for many of the end-of-chapter problems in the text, and several new problems for each chapter, along with strategies for solving them. The focus of the new problems is on real applications of chemical concepts both in everyday life and in related fields, such as biology. The solutions for all even-numbered end-of-chapter problems are included in this book.

- **Instructor's Resource Kit with Solutions**, by Vicky Ellis (Gulf Coast Community College) and Raymond Chang, is a complete manual for teaching a general chemistry course based on *Essential Chemistry*. This unique guide includes demonstrations that can be done in any classroom or assigned for homework, accompanied by discussion questions and tips to ensure success; information on relevant applications, along with references to additional articles and multimedia resources; chapter overviews and outlines; and annotated cross-references to other elements of the text package. In addition, this guide provides complete solutions to all end-of-chapter problems in the text.
- **Test Bank**, by Gary Wolf (Spokane Community College), contains over 2000 multiple choice, short answer, and true-false exam questions. The questions, which are graded in difficulty, are comparable to the problems in the text and include multistep problems that require conceptual analysis.
- **Computerized Test Bank with Algorithms** contains all of the questions in the print Test Bank plus algorithms and over 200 algorithm-based questions that instructors can edit to create their own test templates. This supplement is available in DOS and Windows versions for PC as well as for use with Macintosh computers.
- **Overhead Transparencies** include 200 full-color acetates of important illustrations from this text.
- **Chemistry at Work Videodisc** is a valuable teaching tool that provides access to 50 filmed laboratory demonstrations, as well as tables, illustrations, and photos.
- **Cooperative Chemistry Laboratory Manual**, by Melanie M. Cooper (Clemson University), is an innovative guide featuring open-ended problems designed to simulate experience in a real chemistry lab. Working in groups, students research one problem over a period of weeks, so that they might complete three or four projects during the semester, rather than one pre-programmed experiment per class. The emphasis here is on experimental design, analysis, problem solving, and communication.
- **Primis LabBase**, edited by Joseph Lagowski (The University of Texas at Austin), is a data-base collection of general chemistry lab experiments culled from the *Journal of Chemical Education* and experiments that Professor Lagowski has used at The University of Texas. Instructors can choose from over 40 experiments to design a customized lab manual.

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Raymond Chang

ESSENTIAL CHEMISTRY

CONTENTS IN BRIEF

	PREFACE	xxiii
CHAPTER 1	INTRODUCTION	2
CHAPTER 2	ATOMS, MOLECULES, AND IONS	26
CHAPTER 3	STOICHIOMETRY	52
CHAPTER 4	REACTIONS IN AQUEOUS SOLUTIONS	86
CHAPTER 5	GASES	116
CHAPTER 6	ENERGY RELATIONSHIPS IN CHEMICAL REACTIONS	148
CHAPTER 7	THE ELECTRONIC STRUCTURE OF ATOMS	178
CHAPTER 8	THE PERIODIC TABLE	214
CHAPTER 9	CHEMICAL BONDING I: THE COVALENT BOND	248
CHAPTER 10	CHEMICAL BONDING II: MOLECULAR GEOMETRY AND HYBRIDIZATION OF ATOMIC ORBITALS	274
CHAPTER 11	INTERMOLECULAR FORCES AND LIQUIDS AND SOLIDS	306
CHAPTER 12	PHYSICAL PROPERTIES OF SOLUTIONS	338
CHAPTER 13	INTRODUCTION TO ORGANIC CHEMISTRY	366
CHAPTER 14	ORGANIC POLYMERS—SYNTHETIC AND NATURAL	396
CHAPTER 15	CHEMICAL EQUILIBRIUM	416
CHAPTER 16	ACIDS AND BASES	446
CHAPTER 17	ACID-BASE EQUILIBRIA AND SOLUBILITY EQUILIBRIA	480

CHAPTER 18 THE CHEMISTRY OF COORDINATION COMPOUNDS	512
CHAPTER 19 THERMODYNAMICS	534
CHAPTER 20 REDOX REACTIONS AND ELECTROCHEMISTRY	560
CHAPTER 21 CHEMICAL KINETICS	598
CHAPTER 22 NUCLEAR CHEMISTRY	634
APPENDIX 1 UNITS FOR THE GAS CONSTANT	665
APPENDIX 2 SELECTED THERMODYNAMIC DATA AT 1 ATM AND 25°C	667
APPENDIX 3 MATHEMATICAL OPERATIONS	673
APPENDIX 4 THE ELEMENTS AND THE DERIVATION OF THEIR NAMES AND SYMBOLS	675
GLOSSARY	681
ANSWERS TO EVEN-NUMBERED PROBLEMS	693
INDEX	703
PHOTO CREDITS	717

CONTENTS

PREFACE xxiii

ACKNOWLEDGMENTS xxvii

CHAPTER 1

INTRODUCTION

2

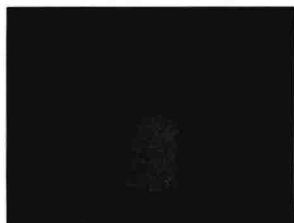


- 1.1 The Study of Chemistry** 4
How to Study Chemistry 4
- 1.2 Classification of Matter** 4
Substances and Mixtures 5 • Elements and Compounds 6
- 1.3 Physical and Chemical Properties of Matter** 8
- 1.4 Measurement** 8
SI Units 9 • Mass and Weight 9 • Volume 10 • Density 11 •
Temperature 12
- 1.5 Handling Numbers** 13
Scientific Notation 13 • *Addition and Subtraction* 13 •
Multiplication and Division 14 • Significant Figures 14 •
Guidelines for Using Significant Figures 15 • *Accuracy and
Precision* 18
- 1.6 The Factor-Label Method of Solving Problems** 18
- Summary** 21
- Key Words** 22
- Questions and Problems** 22

CHAPTER 2

ATOMS, MOLECULES, AND IONS

26



- 2.1 The Atomic Theory** 28
- 2.2 The Structure of the Atom** 29
The Electron 29 • Radioactivity 31 • The Proton and the
Nucleus 32 • The Neutron 33
- 2.3 Atomic Number, Mass Number, and Isotopes** 34
- 2.4 The Periodic Table** 35

- 2.5 Molecules and Ions** 36
Molecules 36 • Ions 37
- 2.6 Chemical Formulas** 38
Molecular Formulas 38 • Empirical Formulas 39
- 2.7 Naming Compounds** 41
Ionic Compounds 41 • Molecular Compounds 43 • Acids and Bases 45 • *Naming Acids* 45 • *Naming Bases* 47
- Summary** 47
- Key Words** 48
- Questions and Problems** 48

CHAPTER 3**STOICHIOMETRY**

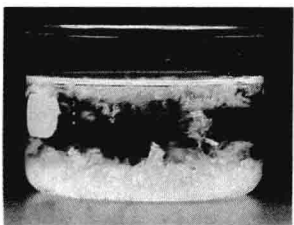
52



- 3.1 Atomic Mass** 54
Average Atomic Mass 54
- 3.2 Molar Mass of an Element and Avogadro's Number** 55
- 3.3 Molecular Mass** 58
- 3.4 The Mass Spectrometer** 60
- 3.5 Percent Composition of Compounds** 61
- 3.6 Experimental Determination of Empirical Formulas** 64
Determination of Molecular Formulas 65
- 3.7 Chemical Reactions and Chemical Equations** 66
Writing Chemical Equations 67 • Balancing Chemical Equations 68
- 3.8 Amounts of Reactants and Products** 71
- 3.9 Limiting Reagents and Yields of Reactions** 74
Yields of Reactions 77
- Summary** 79
- Key Words** 79
- Questions and Problems** 79

CHAPTER 4**REACTIONS IN AQUEOUS SOLUTIONS**

86

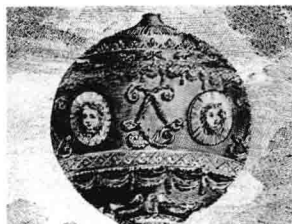


- 4.1 General Properties of Aqueous Solutions** 88
Electrolytes versus Nonelectrolytes 88
- 4.2 Precipitation Reactions** 90
Solubility 90 • Molecular Equations and Ionic Equations 92
- 4.3 Acid-Base Reactions** 93
General Properties of Acids and Bases 94 • *Acids* 94 •

	<i>Bases</i>	94	•	Brønsted Acids and Bases	94	•	Acid-Base Neutralization	96
4.4	Oxidation-Reduction Reactions	97		Oxidation Number	99	•	Activity Series	102
4.5	Concentration and Dilution of Solutions	103		Concentration of Solutions	104	•	Dilution of Solutions	105
4.6	Solution Stoichiometry	107		Gravimetric Analysis	107	•	Titrations	109
	Summary	110		Key Words	111		Questions and Problems	111

CHAPTER 5**GASES**

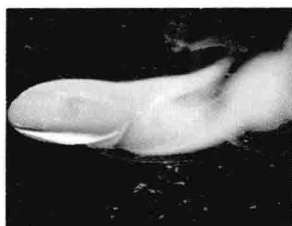
116



5.1	Substances that Exist as Gases	118
5.2	Pressure of a Gas	119
	SI Units of Pressure	119
	• Atmospheric Pressure	120
5.3	The Gas Laws	121
	The Pressure-Volume Relationship: Boyle's Law	121
	• The Temperature-Volume Relationship: Charles' and Gay-Lussac's Law	123
	• The Volume-Amount Relationship: Avogadro's Law	125
5.4	The Ideal Gas Equation	126
	Density and Molar Mass of a Gaseous Substance	129
5.5	Dalton's Law of Partial Pressures	131
5.6	The Kinetic Molecular Theory of Gases	135
	Distribution of Molecular Speeds	136
5.7	Deviation from Ideal Behavior	138
	Summary	141
	Key Words	142
	Questions and Problems	142

CHAPTER 6**ENERGY RELATIONSHIPS IN CHEMICAL REACTIONS**

148

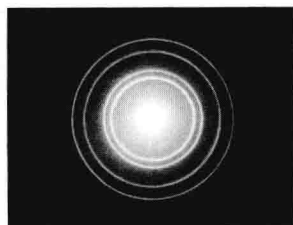


6.1	Energy	150
6.2	Energy Changes in Chemical Reactions	151
6.3	Enthalpy	152
	Thermochemical Equations	153
6.4	Calorimetry	154
	Specific Heat and Heat Capacity	154
	• Constant-Volume Calorimetry	155
	• Constant-Pressure Calorimetry	158

- 6.5 Standard Enthalpy of Formation and Reaction** 159
The Direct Method 161 • The Indirect Method 162
- 6.6 Introduction to Thermodynamics** 163
The First Law of Thermodynamics 164 • Work and Heat 166 •
Enthalpy and the First Law of Thermodynamics 168
- Summary** 170
- Key Words** 171
- Questions and Problems** 171

CHAPTER 7**THE ELECTRONIC STRUCTURE OF ATOMS**

178



- 7.1 From Classical Physics to Quantum Theory** 180
Electromagnetic Radiation 181 • Planck's Quantum Theory 182
- 7.2 The Photoelectric Effect** 183
- 7.3 Bohr's Theory of the Hydrogen Atom** 185
Emission Spectra 185 • Emission Spectrum of the Hydrogen Atom 186
- 7.4 The Dual Nature of the Electron** 189
- 7.5 Quantum Mechanics** 191
- 7.6 Quantum Mechanical Treatment of the Hydrogen Atom** 192
- 7.7 Quantum Numbers** 193
The Principle Quantum Number (n) 193 • The Angular Momentum Quantum Number (l) 193 • The Magnetic Quantum Number (m_l) 194 • The Electron Spin Quantum Number (m_s) 194
- 7.8 Atomic Orbitals** 194
 s Orbitals 195 • p Orbitals 196 • d Orbitals and Other Higher-Energy Orbitals 196 • The Energies of Orbitals 197
- 7.9 Electron Configuration** 199
The Pauli Exclusion Principle 200 • Diamagnetism and Paramagnetism 200 • The Shielding Effect in Many-Electron Atoms 201 • Hund's Rule 202 • General Rules for Assigning Electrons to Atomic Orbitals 203
- 7.10 The Building-Up Principle** 204
- Summary** 208
- Key Words** 209
- Questions and Problems** 209

CHAPTER 8

THE PERIODIC TABLE

214

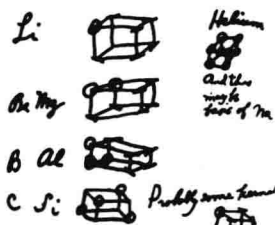


- 8.1 Development of the Periodic Table** 216
- 8.2 Periodic Classification of the Elements** 217
Electron Configurations of Cations and Anions 220 • *Ions Derived from Representative Elements* 220 • *Cations Derived from Transition Metals* 220
- 8.3 Periodic Variation in Physical Properties** 221
Effective Nuclear Charge 221 • Atomic Radius 222 • Ionic Radius 224
- 8.4 Ionization Energy** 226
- 8.5 Electron Affinity** 229
- 8.6 Chemical Properties within Individual Groups** 231
General Trends in Chemical Properties 232 • *Hydrogen* ($1s^1$) 232 • *Group 1A Elements* (ns^1 , $n \geq 2$) 232 • *Group 2A Elements* (ns^2 , $n \geq 2$) 233 • *Group 3A Elements* (ns^2np^1 , $n \geq 2$) 235 • *Group 4A Elements* (ns^2np^2 , $n \geq 2$) 235 • *Group 5A Elements* (ns^2np^3 , $n \geq 2$) 236 • *Group 6A Elements* (ns^2np^4 , $n \geq 2$) 237 • *Group 7A Elements* (ns^2np^5 , $n \geq 2$) 238 • *Group 8A Elements* (ns^2np^6 , $n \geq 2$) 239 • Properties of Oxides across a Period 240
- Summary** 241
- Key Words** 242
- Questions and Problems** 242

CHAPTER 9

CHEMICAL BONDING I: THE COVALENT BOND

248



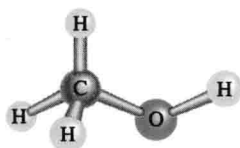
- 9.1 Lewis Dot Symbols** 250
- 9.2 The Covalent Bond** 250
- 9.3 Electronegativity** 253
Electronegativity and Oxidation Number 255
- 9.4 Writing Lewis Structures** 256
- 9.5 Formal Charge and Lewis Structure** 258
- 9.6 The Concept of Resonance** 261
- 9.7 Exceptions to the Octet Rule** 262
The Incomplete Octet 263 • Odd-Electron Molecules 263 • The Expanded Octet 264
- 9.8 Strength of the Covalent Bond** 265
Use of Bond Energies in Thermochemistry 265

Summary	268
Key Words	269
Questions and Problems	269

CHAPTER 10

CHEMICAL BONDING II: MOLECULAR GEOMETRY AND
HYBRIDIZATION OF ATOMIC ORBITALS

274



10.1 Molecular Geometry	276
Molecules in Which the Central Atom Has No Lone Pairs	276 • AB_2 : Beryllium Chloride ($BeCl_2$) 277 • AB_3 : Boron Trifluoride (BF_3) 278 • AB_4 : Methane (CH_4) 278 • AB_5 : Phosphorus Pentachloride (PCl_5) 279 • AB_6 : Sulfur Hexafluoride (SF_6) 279 • Molecules in Which the Central Atom Has One or More Lone Pairs
280 • AB_2E : Sulfur Dioxide (SO_2) 280 • AB_3E : Ammonia (NH_3) 281 • AB_2E_2 : Water (H_2O) 281 • AB_4E : Sulfur Tetrafluoride (SF_4) 282 • Geometry of Molecules with More than One Central Atom	282 • Guidelines for Applying the VSEPR Model 284
10.2 Dipole Moments	285
10.3 Hybridization of Atomic Orbitals	288
sp Hybridization 289 • sp^2 Hybridization 290 • sp^3 Hybridization 291 • Procedure for Hybridizing Atomic Orbitals 293 • Hybridization of s , p , and d Orbitals 296	
10.4 Hybridization in Molecules Containing Double and Triple Bonds	298
Summary	301
Key Words	301
Questions and Problems	301

CHAPTER 11

INTERMOLECULAR FORCES AND LIQUIDS AND
SOLIDS

306



11.1 The Kinetic Molecular Theory of Liquids and Solids	308
11.2 Intermolecular Forces	308
Dipole-Dipole Forces 309 • Ion-Dipole Forces 309 • Dispersion Forces 310 • The Hydrogen Bond 312	
11.3 The Liquid State	314
Surface Tension 314 • Viscosity 315 • The Structure and Properties of Water 316	