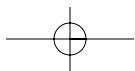
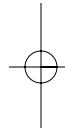
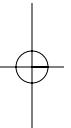
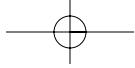
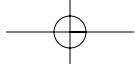


BRIEF CONTENTS

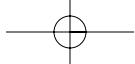
1	An Introduction to Chemistry	1	11	Chemical Bonds: The Formation of Compounds from Atoms	224
2	Standards for Measurement	14	12	The Gaseous State of Matter	265
3	Elements and Compounds	47	13	Properties of Liquids	307
4	Properties of Matter	65	14	Solutions	336
5	Early Atomic Theory and Structure	84	15	Acids, Bases, and Salts	373
6	Nomenclature of Inorganic Compounds	103	16	Chemical Equilibrium	405
7	Quantitative Composition of Compounds	127	17	Oxidation–Reduction	437
8	Chemical Equations	150		Appendixes	A-1
9	Calculations from Chemical Equations	176		Glossary	G-1
10	Modern Atomic Theory and the Periodic Table	203		Photo Credits	PC-1
				Index	I-1





CONTENTS

<p>1</p> <p>An Introduction to Chemistry</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">1.1</td> <td>Why Study Chemistry?</td> <td style="text-align: right;">2</td> </tr> <tr> <td>1.2</td> <td>The Nature of Chemistry</td> <td style="text-align: right;">2</td> </tr> <tr> <td>1.3</td> <td>Thinking Like a Chemist</td> <td style="text-align: right;">3</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Clearing the Fog </td> </tr> <tr> <td>1.4</td> <td>A Scientific Approach to Problem Solving</td> <td style="text-align: right;">4</td> </tr> <tr> <td>1.5</td> <td>The Scientific Method</td> <td style="text-align: right;">5</td> </tr> <tr> <td>1.6</td> <td>The Particulate Nature of Matter</td> <td style="text-align: right;">6</td> </tr> <tr> <td>1.7</td> <td>Physical States of Matter</td> <td style="text-align: right;">6</td> </tr> <tr> <td>1.8</td> <td>Classifying Matter</td> <td style="text-align: right;">8</td> </tr> <tr> <td></td> <td>Review</td> <td style="text-align: right;">11</td> </tr> <tr> <td></td> <td>Review Questions</td> <td style="text-align: right;">12</td> </tr> <tr> <td></td> <td>Paired Exercises, Additional Exercises</td> <td style="text-align: right;">12</td> </tr> </table>	1.1	Why Study Chemistry?	2	1.2	The Nature of Chemistry	2	1.3	Thinking Like a Chemist	3	CHEMISTRY IN ACTION Clearing the Fog			1.4	A Scientific Approach to Problem Solving	4	1.5	The Scientific Method	5	1.6	The Particulate Nature of Matter	6	1.7	Physical States of Matter	6	1.8	Classifying Matter	8		Review	11		Review Questions	12		Paired Exercises, Additional Exercises	12	<p>1</p> <p>Paired Exercises, Additional Exercises</p> <p>Challenge Exercises</p> <p>Answers to Practice Exercises</p> <p>3</p> <p>Elements and Compounds</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">3.1</td> <td>Elements</td> <td style="text-align: right;">48</td> </tr> <tr> <td>3.2</td> <td>Distribution of Elements</td> <td style="text-align: right;">49</td> </tr> <tr> <td>3.3</td> <td>Names of the Elements</td> <td style="text-align: right;">49</td> </tr> <tr> <td>3.4</td> <td>Symbols of the Elements</td> <td style="text-align: right;">51</td> </tr> <tr> <td>3.5</td> <td>Introduction to the Periodic Table</td> <td style="text-align: right;">52</td> </tr> <tr> <td>3.6</td> <td>Elements in Their Natural States</td> <td style="text-align: right;">54</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Using Oxygen to Revive Damaged Art </td> </tr> <tr> <td>3.7</td> <td>Elements That Exist as Diatomic Molecules</td> <td style="text-align: right;">55</td> </tr> <tr> <td>3.8</td> <td>Compounds</td> <td style="text-align: right;">56</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Cars: Is Hydrogen the Answer? </td> </tr> <tr> <td>3.9</td> <td>Chemical Formulas</td> <td style="text-align: right;">59</td> </tr> <tr> <td></td> <td>Review</td> <td style="text-align: right;">61</td> </tr> <tr> <td></td> <td>Review Questions</td> <td style="text-align: right;">61</td> </tr> <tr> <td></td> <td>Paired Exercises, Additional Exercises</td> <td style="text-align: right;">62</td> </tr> <tr> <td></td> <td>Challenge Exercises</td> <td style="text-align: right;">62</td> </tr> <tr> <td></td> <td>Answers to Practice Exercises</td> <td style="text-align: right;">64</td> </tr> </table>	3.1	Elements	48	3.2	Distribution of Elements	49	3.3	Names of the Elements	49	3.4	Symbols of the Elements	51	3.5	Introduction to the Periodic Table	52	3.6	Elements in Their Natural States	54	CHEMISTRY IN ACTION Using Oxygen to Revive Damaged Art			3.7	Elements That Exist as Diatomic Molecules	55	3.8	Compounds	56	CHEMISTRY IN ACTION Cars: Is Hydrogen the Answer?			3.9	Chemical Formulas	59		Review	61		Review Questions	61		Paired Exercises, Additional Exercises	62		Challenge Exercises	62		Answers to Practice Exercises	64
1.1	Why Study Chemistry?	2																																																																																			
1.2	The Nature of Chemistry	2																																																																																			
1.3	Thinking Like a Chemist	3																																																																																			
CHEMISTRY IN ACTION Clearing the Fog																																																																																					
1.4	A Scientific Approach to Problem Solving	4																																																																																			
1.5	The Scientific Method	5																																																																																			
1.6	The Particulate Nature of Matter	6																																																																																			
1.7	Physical States of Matter	6																																																																																			
1.8	Classifying Matter	8																																																																																			
	Review	11																																																																																			
	Review Questions	12																																																																																			
	Paired Exercises, Additional Exercises	12																																																																																			
3.1	Elements	48																																																																																			
3.2	Distribution of Elements	49																																																																																			
3.3	Names of the Elements	49																																																																																			
3.4	Symbols of the Elements	51																																																																																			
3.5	Introduction to the Periodic Table	52																																																																																			
3.6	Elements in Their Natural States	54																																																																																			
CHEMISTRY IN ACTION Using Oxygen to Revive Damaged Art																																																																																					
3.7	Elements That Exist as Diatomic Molecules	55																																																																																			
3.8	Compounds	56																																																																																			
CHEMISTRY IN ACTION Cars: Is Hydrogen the Answer?																																																																																					
3.9	Chemical Formulas	59																																																																																			
	Review	61																																																																																			
	Review Questions	61																																																																																			
	Paired Exercises, Additional Exercises	62																																																																																			
	Challenge Exercises	62																																																																																			
	Answers to Practice Exercises	64																																																																																			
<p>2</p> <p>Standards for Measurement</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">2.1</td> <td>Scientific Notation</td> <td style="text-align: right;">15</td> </tr> <tr> <td>2.2</td> <td>Measurement and Uncertainty</td> <td style="text-align: right;">16</td> </tr> <tr> <td>2.3</td> <td>Significant Figures</td> <td style="text-align: right;">18</td> </tr> <tr> <td>2.4</td> <td>Significant Figures in Calculations</td> <td style="text-align: right;">20</td> </tr> <tr> <td>2.5</td> <td>The Metric System</td> <td style="text-align: right;">23</td> </tr> <tr> <td>2.6</td> <td>Problem Solving</td> <td style="text-align: right;">24</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Keeping Track of Units </td> </tr> <tr> <td>2.7</td> <td>Measuring Mass and Volume</td> <td style="text-align: right;">29</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Setting Standards </td> </tr> <tr> <td>2.8</td> <td>Measurement of Temperature</td> <td style="text-align: right;">33</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Taking the Temperature of Old Faithful </td> </tr> <tr> <td>2.9</td> <td>Density</td> <td style="text-align: right;">36</td> </tr> <tr> <td></td> <td>Review</td> <td style="text-align: right;">37</td> </tr> <tr> <td></td> <td>Review Questions</td> <td style="text-align: right;">41</td> </tr> </table>	2.1	Scientific Notation	15	2.2	Measurement and Uncertainty	16	2.3	Significant Figures	18	2.4	Significant Figures in Calculations	20	2.5	The Metric System	23	2.6	Problem Solving	24	CHEMISTRY IN ACTION Keeping Track of Units			2.7	Measuring Mass and Volume	29	CHEMISTRY IN ACTION Setting Standards			2.8	Measurement of Temperature	33	CHEMISTRY IN ACTION Taking the Temperature of Old Faithful			2.9	Density	36		Review	37		Review Questions	41	<p>2</p> <p>Paired Exercises, Additional Exercises</p> <p>Challenge Exercises</p> <p>Answers to Practice Exercises</p> <p>3</p> <p>Properties of Matter</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">4.1</td> <td>Properties of Substances</td> <td style="text-align: right;">66</td> </tr> <tr> <td colspan="3" style="background-color: #d9e1f2; padding: 5px;"> CHEMISTRY IN ACTION Making Money </td> </tr> <tr> <td>4.2</td> <td>Physical Changes</td> <td style="text-align: right;">67</td> </tr> <tr> <td>4.3</td> <td>Chemical Changes</td> <td style="text-align: right;">68</td> </tr> <tr> <td>4.4</td> <td>Conservation of Mass</td> <td style="text-align: right;">70</td> </tr> <tr> <td>4.5</td> <td>Energy</td> <td style="text-align: right;">71</td> </tr> <tr> <td>4.6</td> <td>Heat: Quantitative Measurement</td> <td style="text-align: right;">72</td> </tr> </table>	4.1	Properties of Substances	66	CHEMISTRY IN ACTION Making Money			4.2	Physical Changes	67	4.3	Chemical Changes	68	4.4	Conservation of Mass	70	4.5	Energy	71	4.6	Heat: Quantitative Measurement	72																					
2.1	Scientific Notation	15																																																																																			
2.2	Measurement and Uncertainty	16																																																																																			
2.3	Significant Figures	18																																																																																			
2.4	Significant Figures in Calculations	20																																																																																			
2.5	The Metric System	23																																																																																			
2.6	Problem Solving	24																																																																																			
CHEMISTRY IN ACTION Keeping Track of Units																																																																																					
2.7	Measuring Mass and Volume	29																																																																																			
CHEMISTRY IN ACTION Setting Standards																																																																																					
2.8	Measurement of Temperature	33																																																																																			
CHEMISTRY IN ACTION Taking the Temperature of Old Faithful																																																																																					
2.9	Density	36																																																																																			
	Review	37																																																																																			
	Review Questions	41																																																																																			
4.1	Properties of Substances	66																																																																																			
CHEMISTRY IN ACTION Making Money																																																																																					
4.2	Physical Changes	67																																																																																			
4.3	Chemical Changes	68																																																																																			
4.4	Conservation of Mass	70																																																																																			
4.5	Energy	71																																																																																			
4.6	Heat: Quantitative Measurement	72																																																																																			

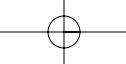


4.7	Energy in Chemical Changes	74	6.5	Naming Compounds Containing Polyatomic Ions	116			
CHEMISTRY IN ACTION Popping Popcorn								
4.8	Conservation of Energy	75	6.6	Acids	118			
	Review	76		Review	120			
	Review Questions	77		Review Questions	121			
	Paired Exercises, Additional Exercises			Paired Exercises, Additional Exercises				
	Challenge Exercises	77		Challenge Exercises	122			
	Answers to Practice Exercises	80		Answers to Practice Exercises	124			
PUTTING IT TOGETHER Review for Chapters 1–4								
		81	PUTTING IT TOGETHER Review for Chapters 5–6					
5	Early Atomic Theory and Structure	84	7	Quantitative Composition of Compounds	127			
5.1	Early Thoughts	85	7.1	The Mole	128			
5.2	Dalton's Model of the Atom	85	7.2	Molar Mass of Compounds	132			
5.3	Composition of Compounds	86	7.3	Percent Composition of Compounds	136			
5.4	The Nature of Electric Charge	87	CHEMISTRY IN ACTION Vanishing Coins?					
5.5	Discovery of Ions	88	7.4	Empirical Formula versus Molecular Formula	139			
5.6	Subatomic Parts of the Atom	88	7.5	Calculating Empirical Formulas	140			
5.7	The Nuclear Atom	91	7.6	Calculating the Molecular Formula from the Empirical Formula	143			
5.8	Isotopes of the Elements	94		Review	145			
CHEMISTRY IN ACTION Isotope Detectives								
5.9	Atomic Mass	95		Review Questions	145			
	Review	98		Paired Exercises, Additional Exercises				
	Review Questions	99		Challenge Exercises	146			
	Paired Exercises, Additional Exercises			Answers to Practice Exercises	149			
	Challenge Exercises	100						
	Answers to Practice Exercises	102						
6	Nomenclature of Inorganic Compounds	103	8	Chemical Equations	150			
6.1	Common and Systematic Names	104	8.1	The Chemical Equation	151			
6.2	Elements and Ions	105	8.2	Writing and Balancing Chemical Equations	152			
CHEMISTRY IN ACTION What's in a Name?								
6.3	Writing Formulas from Names of Ionic Compounds	106	8.3	Information in a Chemical Equation	156			
6.4	Naming Binary Compounds	111	8.4	CHEMISTRY IN ACTION CO Poisoning—A Silent Killer				
			8.5	Types of Chemical Equations	159			
			8.6	Heat in Chemical Reactions	165			
				Global Warming: The Greenhouse Effect	168			

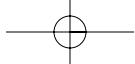
CONTENTS

xxv

9	Review	170	Review	219	
	Review Questions	171	Review Questions	220	
	Paired Exercises, Additional Exercises		Paired Exercises, Additional Exercises		
	Challenge Exercises	172	Challenge Exercises	220	
	Answers to Practice Exercises	175	Answers to Practice Exercises	223	
10	Calculations from Chemical Equations	176	11	Chemical Bonds: The Formation of Compounds from Atoms	224
9.1	A Short Review	177	11.1	Periodic Trends in Atomic Properties	225
9.2	Introduction to Stoichiometry	178	11.2	Lewis Structures of Atoms	228
9.3	Mole-Mole Calculations	180	11.3	The Ionic Bond: Transfer of Electrons from One Atom to Another	230
9.4	Mole-Mass Calculations	182	11.4	Predicting Formulas of Ionic Compounds	236
9.5	Mass-Mass Calculations	184	11.5	The Covalent Bond: Sharing Electrons	238
	CHEMISTRY IN ACTION A Shrinking Technology	186	11.6	Electronegativity	240
9.6	Limiting-Reactant and Yield Calculations	186		CHEMISTRY IN ACTION Trans-forming Fats	242
	Review	192		CHEMISTRY IN ACTION Goal! A Spherical Molecule	243
	Review Questions	193		Lewis Structures of Compounds	244
	Paired Exercises, Additional Exercises			Complex Lewis Structures	247
	Challenge Exercises	193		CHEMISTRY IN ACTION Cleaner Showers through Chemistry	248
	Answers to Practice Exercises	198			
	PUTTING IT TOGETHER Review for Chapters 7–9	199			
10	Modern Atomic Theory and the Periodic Table	203	11.9	Compounds Containing Polyatomic Ions	249
10.1	A Brief History	204	11.10	Molecular Shape	250
10.2	Electromagnetic Radiation	204		CHEMISTRY IN ACTION Strong Enough to Stop a Bullet?	251
	CHEMISTRY IN ACTION You Light Up My Life	205	11.11	The Valence Shell Electron Pair Repulsion (VSEPR) Model	251
10.3	The Bohr Atom	206		Review	255
10.4	Energy Levels of Electrons	207		Review Questions	257
	CHEMISTRY IN ACTION Atomic Clocks	210		Paired Exercises, Additional Exercises	
10.5	Atomic Structures of the First 18 Elements	210		Challenge Exercises	
10.6	Electron Structures and the Periodic Table	214		Answers to Practice Exercises	
	PUTTING IT TOGETHER Review for Chapters 10–11	214			



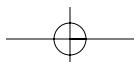
12	The Gaseous State of Matter	265	13.9	Hydrates	319
12.1	General Properties	266			
12.2	The Kinetic-Molecular Theory	266	CHEMISTRY IN ACTION		320
12.3	Measurement of Pressure of Gases	268	Hot Ice—It's a Gas!		
12.4	Dependence of Pressure on Number of Molecules and Temperature	270	13.10	Water, a Unique Liquid	322
12.5	Boyle's Law	271	13.11	Water Purification	326
12.6	Charles' Law	275		Review	330
12.7	Gay-Lussac's Law	279		Review Questions	331
12.8	Combined Gas Laws	280		Paired Exercises, Additional Exercises	
12.9	Dalton's Law of Partial Pressures	283		Challenge Exercises	332
	CHEMISTRY IN ACTION			Answers to Practice Exercises	335
	Messenger Molecules				
12.10	Avogadro's Law	284	14		
12.11	Mole–Mass–Volume Relationships of Gases	285	Solutions		336
12.12	Density of Gases	287	14.1	General Properties of Solutions	337
12.13	Ideal Gas Law	288		CHEMISTRY IN ACTION	
12.14	Gas Stoichiometry	290	Exploding Silicon		338
12.15	Real Gases	292	14.2	Solubility	338
	CHEMISTRY IN ACTION		14.3	Factors Related to Solubility	340
	Wetland Blanket for Global Warming		14.4	Rate of Dissolving Solids	344
		297	14.5	Solutions: A Reaction Medium	345
	Review	298	14.6	Concentration of Solutions	346
	Review Questions	300	14.7	Colligative Properties of Solutions	355
	Paired Exercises, Additional Exercises				
	Challenge Exercises	301	CHEMISTRY IN ACTION		359
	Answers to Practice Exercises	306	The Scoop on Ice Cream		
13	Properties of Liquids	307	14.8	Osmosis and Osmotic Pressure	360
13.1	What Is a Liquid?	308		Review	362
13.2	Evaporation	309		Review Questions	363
13.3	Vapor Pressure	309		Paired Exercises, Additional Exercises	
13.4	Surface Tension	311		Challenge Exercises	365
13.5	Boiling Point	312		Answers to Practice Exercises	368
13.6	Freezing Point or Melting Point	314			
13.7	Changes of State	314	PUTTING IT TOGETHER		369
13.8	The Hydrogen Bond	316	Review for Chapters 12–14		
	CHEMISTRY IN ACTION				
	How Sweet It Is!	317			
15	Acids, Bases, and Salts	373			
15.1	Acids and Bases	374			
15.2	Reactions of Acids	377			

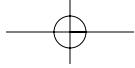


CONTENTS

xxvii

15.3	Reactions of Bases	378	16.8	Effect of Catalysts on Equilibrium	415
CHEMISTRY IN ACTION A Cool Fizz			16.9	Equilibrium Constants	416
15.4	Salts	379	16.10	Ion Product Constant for Water	418
15.5	Electrolytes and Nonelectrolytes	380	16.11	Ionization Constants	420
15.6	Dissociation and Ionization of Electrolytes	381	16.12	Solubility Product Constant	423
15.7	Strong and Weak Electrolytes	383	16.13	Acid–Base Properties of Salts	426
15.8	Ionization of Water	386	16.14	Buffer Solutions: The Control of pH	426
15.9	Introduction to pH	386	CHEMISTRY IN ACTION Exchange of Oxygen and Carbon Dioxide in the Blood		
CHEMISTRY IN ACTION In the Pink— A Sign of Corrosion					427
15.10	Neutralization	389	Review	429	
15.11	Writing Net Ionic Equations	392	Review Questions	430	
15.12	Acid Rain	395	Paired Exercises, Additional Exercises		
15.13	Colloids	396	Challenge Exercises	431	
CHEMISTRY IN ACTION Foam Cars— Wave of the Future?			Answers to Practice Exercises	436	
15.14	Properties of Colloids	397	17	Oxidation–Reduction	437
15.15	Applications of Colloidal Properties	398	17.1	Oxidation Number	438
	Review	399	17.2	Oxidation–Reduction	441
	Review Questions	401	17.3	Balancing Oxidation–Reduction Equations	442
	Paired Exercises, Additional Exercises		17.4	Balancing Ionic Redox Equations	446
	Challenge Exercises	401	CHEMISTRY IN ACTION Sensitive Sunglasses		
	Answers to Practice Exercises	404			447
16	Chemical Equilibrium	405	17.5	Activity Series of Metals	450
16.1	Reversible Reactions	406	17.6	Electrolytic and Voltaic Cells	452
16.2	Rates of Reaction	407	CHEMISTRY IN ACTION Superbattery Uses Hungry Iron Ions		
16.3	Chemical Equilibrium	408			457
CHEMISTRY IN ACTION New Ways in Fighting Cavities and Avoiding the Drill			Review	458	
16.4	Le Châtelier's Principle	409	Review Questions	459	
16.5	Effect of Concentration on Equilibrium	410	Paired Exercises, Additional Exercises		
16.6	Effect of Volume on Equilibrium	410	Challenge Exercises	460	
16.7	Effect of Temperature on Equilibrium	413	Answers to Practice Exercises	463	
		414	PUTTING IT TOGETHER Review for Chapters 15–17		
					464



**Appendices**

I. Mathematical Review	A-1
II. Using a Scientific Calculator	A-11
III. Units of Measurement	A-16
IV. Vapor Pressure of Water at Various Temperatures	A-17
V. Solubility Table	A-18
VI. Selected Answers	A-19
VII. Answers to Putting It Together Review Exercises	A-34

Glossary**G-1****Photo Credits****PC-1****Index****I-1**