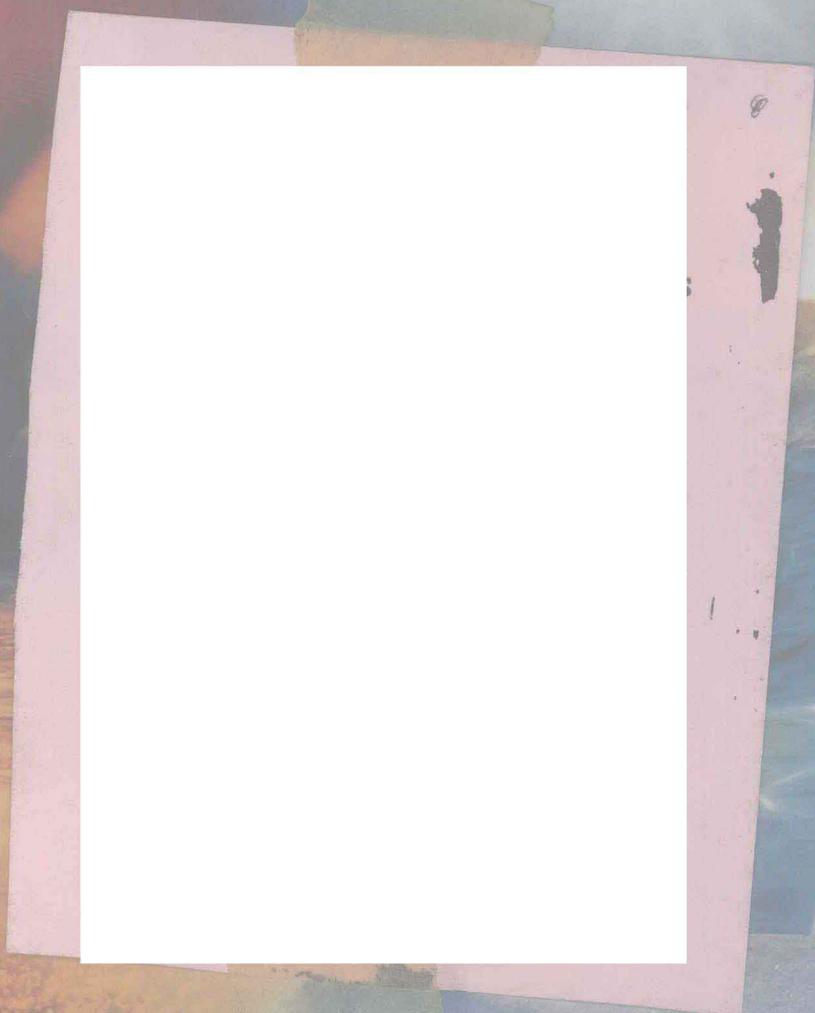


Chemistry

for Changing Times

Eighth Edition



John W. Hill • Doris K. Kolb

Chemistry *for Changing Times*

Eighth Edition

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Preface

Chemistry for Changing Times is now in its eighth edition. Times have indeed changed since the first edition appeared in 1972, and the book has changed accordingly. Our knowledge base has expanded enormously in the quarter century that has passed since that first edition, yet we have resisted the pressure to increase the size of the book. This has forced us to make some tough choices in deciding what to include and what to leave out. We live in what has been called the “information age.” Our main focus, therefore, is not so much on providing information as it is on helping students evaluate that information.

We believe that a chemistry course for students who are not majoring in science should be quite different from the course we offer our science majors. It should present basic chemical concepts with intellectual honesty, but it should not focus on esoteric theories or rigorous mathematics. It should include lots of modern everyday applications. The textbook should be appealing to look at, easy to understand, and interesting to read.

Three-fourths of the legislation considered by the United States Congress involves questions having to do with science or technology, yet only rarely does a scientist or engineer enter the field of politics. Most of the people who make important decisions regarding our health and our environment are not trained in science, but it is critical that these decision makers have some measure of scientific literacy. A chemistry course for students who are not science majors should emphasize practical applications of chemistry to problems involving such things as environmental pollution, radioactivity, energy sources, and human health. The students who take our liberal arts chemistry courses include future teachers, lawyers, accountants, journalists, and judges. There are probably some future legislators, too.

I Objectives

Our main objectives in a chemistry course for students who are not majoring in science are:

- To attract as many students as possible. If students are not enrolled in the course, we cannot teach them.
- To use topics of current interest to illustrate chemical principles. We want students to appreciate the importance of chemistry in the real world.
- To relate chemical problems to the everyday lives of our students. Chemical problems seem more significant to students if they can see a personal connection.
- To instill in students an appreciation for chemistry as an open-ended learning experience. We hope that our students will want to continue learning throughout their lives.
- To acquaint students with scientific methods. We want students to be able to read about science and technology with some degree of critical judgment.

- To impart to students a sense of scientific literacy. We want our students to develop such a comfortable knowledge of science that they find news articles relating to science interesting rather than intimidating.

I Changes in the Eighth Edition

All the text has been thoroughly updated to reflect the latest scientific knowledge. In addition, we have responded to suggestions from users and reviewers of the seventh edition and have used our own writing and teaching experience to make the following changes:

- For this eighth edition, we have added critical thinking exercises in each chapter. These exercises are introduced in Chapter 1, where we have included worked-out examples. We have found that students initially need guidance and practice in working through critical thinking exercises, but with some experience they can do quite well on their own.
- At the request of several users and reviewers, we have added a new section (Section 6.9) on gas laws. This addition includes four new figures and four additional examples and exercises. At the end of the chapter, 10 new review questions and 14 new problems have been added.
- A new section (Section 8.7, Explosive Reactions) has been added to Chapter 8.
- Several applications have been moved from later to earlier chapters. For example, some of the discussion of acid rain has been moved from Chapter 12 to Chapter 7, and the reactions of salicylic acid and some of the material on salicylates is now discussed in Chapter 9 rather than in Chapter 19. We also make extensive cross references to later applications of principles that are introduced in early chapters.
- There are several new applications boxes. One entitled “Why Doesn’t ‘Stomach Acid’ Dissolve the Stomach?” appears in Chapter 7. Others include one on fake fats in Chapter 16 and one on nitric oxide and the learning process in Chapter 19. New box features in Chapter 20 include “What Kills You? What Makes You Sick?” and “How Cigarette Smoking Causes Cancer.”
- We have chosen several new photographs and produced new diagrams to improve the pedagogy and the visual appeal of the book. Several of the new illustrations are computer-generated molecular graphics.

I Use of Color

New color photographs and diagrams have been added. Visual material adds greatly to the general appeal of a textbook. Color diagrams can also be highly instructive, and colorful photographs relating to descriptive chemistry do much to enhance the learning process.

I Readability

Over the years, students have told us that they have found this textbook easy to read. The language is simple, and the style is conversational. Explanations are clear and easy to understand. We trust that the friendly tone of the book has been maintained in this edition.

I Units of Measurement

The United States continues to cling to the traditional “English” system for many kinds of measurement even though the metric system has long been used internationally. A modern version of the metric system, the *Système International* (SI), is now widely used, especially by scientists. So what units should be used in a text for liberal arts students? In presenting chemical principles, we use SI units for the most part. In other parts of the book we use whatever units the students are most likely to come across elsewhere in that same context.

I Chemical Structures

The structures of many complicated molecules are presented in the text, especially in the later chapters. These structures are presented mainly to emphasize that they are actually known and to illustrate the fact that substances with similar properties often have similar structures. Students should not feel that they must learn all these structures, but they should take the time to look at them. We hope that they will come to recognize familiar features in these molecules.

I Glossary

The glossary (Appendix E) gives definitions of terms that appear in **boldface** throughout the text. These terms include all the key terms listed at the ends of the chapters.

I Questions and Problems

The end-of-chapter exercises include review questions, problems, and suggested projects. Answers to many review questions and to all the odd-numbered problems are given in Appendix F. Problems are given within some of the chapters, with worked-out examples followed by similar exercises. Answers to all the in-chapter exercises are also given in Appendix F.

I References and Suggested Readings

An updated list of recommended books and articles appears at the end of each chapter. A student whose interest has been sparked by a topic can delve more deeply into the subject in the library. Instructors might also find these lists useful.

I Supplementary Materials

The most important learning aid is the teacher. In order to make the instructor’s job easier and enrich the education of students, we have provided a variety of supplementary materials.

New York Times Themes of the Times. This newspaper-format off-print uses current chemistry-related articles to emphasize the importance and relevance of chemistry in our lives. (Free in quantity to qualified adopters.)

Chemistry for Changing Times World Wide Web Center (<http://www.prenhall.com/~chem>). Through current news articles, this user-friendly site emphasizes

that chemistry is an open-ended learning experience, and gives real examples of how it affects our daily lives. The site also offers interactive quizzes where they receive guided instruction, get graded results, and can mail their results electronically to their professor.

Student Study Guide by John W. Hill of University of Wisconsin–River Falls and Richard Jones of the Sinclair Community College. This useful guide contains learning objectives, chapter outlines, key terms, and additional problems along with self-tests and answers.

Test Item File by David R. Gano, Minot State University, contains over 1600 multiple choice questions that are referenced to the text.

Computerized PH Custom Test. This computerized test generator is available in Windows and Macintosh.

Transparencies. This set contains 150 four-color acetates.

Instructor's Resource Manual by Paul Karr of Wayne State College includes lecture outlines, answers and solutions to all questions and problems which are not answered by the authors in the answer appendix, suggested in-class demonstrations recommended by Doris Kolb, and other suggested resources. The lecture outline is also available in an electronic format.

Chemical Investigations for Changing Times, Eighth Edition, by Alton C. Hassell and Paula Marshall contains forty-one laboratory experiments and is specifically referenced to *Chemistry for Changing Times*. An *Instructor's Manual* prepared by Paula Marshall is also available.

I Acknowledgments

Through the last quarter century we have benefited so much from hundreds of helpful reviews. It would take far too many pages to list all of those reviewers here. Many of you have contributed to the flavor of the book and helped us minimize our errors. Please know that your contributions are deeply appreciated. For this edition, we are grateful for challenging reviews from:

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Cynthia S. Hill prepared much of the original material on biochemistry, food, and health and fitness. Her special contributions are acknowledged on the title page.

Four of the verses that appear in this volume were first published in the *Journal of Chemical Education*. We acknowledge with thanks the permission to reprint them here. Those verses plus all of the others, including the chapter openers, were written by Doris Kolb.

We also want to thank our colleagues at the University of Wisconsin–River Falls and Bradley University for all their help and support.

We have been blessed with a team of careful and considerate editors. We especially appreciate all the help we have received from Ben Roberts and from our outstanding production editor, Andrea Fincke.

We owe a very special kind of thanks to our wonderful spouses, Ina and Ken. Ina has done typing, library research, and so many other things. Ken has done chapter reviews, made suggestions, and given invaluable help with this eighth edition. Most of all, we are grateful to both of them for their enduring love and their boundless patience.

We thank all those many students whose enthusiasm has made teaching such a joy. It is gratifying to have students learn what you are trying to teach them, but it is a supreme pleasure to find that they want to learn even more. Finally, we want to thank all of you who have made so many helpful suggestions. We welcome and appreciate all your comments, corrections, and criticisms.

J. W. H.
D. K. K.

To the Student

I Welcome to Our Chemical World!

Chemistry is fun. Through this book, we would like to share with you some of the excitement of chemistry and some of the joy of learning about it. We hope to convince you that chemistry does not need to be excluded from your learning experiences. Learning chemistry will enrich your life—now and long after this course is over—through a better understanding of the natural world, the technological questions now confronting us, and the choices we must face as citizens within a scientific and technological society.

I Chemistry Directly Affects Our Lives

How does the human body work? How does aspirin cure our headaches? Do steroids enhance athletic ability? Is table salt poisonous? Can scientists cure genetic diseases? Why do most weight-loss diets seem to work in the short run but fail in the long run? Does fasting “cleanse” the body? Why do our moods swing from happy to sad? Can a chemical test on urine predict possible suicide attempts? How does penicillin kill bacteria without harming our healthy body cells? Chemists have found answers to questions such as these and continue to seek the knowledge that will unlock still other secrets of our universe. As these mysteries are resolved, the direction of our lives often changes—sometimes dramatically.

We live in a chemical world—a world of drugs, biocides, food additives, fertilizers, detergents, cosmetics, and plastics. We live in a world with toxic wastes, polluted air and water, and dwindling petroleum reserves. Knowledge of chemistry will help you better understand the benefits and hazards of this world and enable you to make intelligent decisions in the future.

I Chemical Dependency

We are all chemically dependent. Even in the womb, we depend on a constant supply of oxygen, water, glucose, and a multitude of other chemicals.

Our bodies are intricate chemical factories. They are durable but delicate systems. A myriad of chemical reactions that allow our bodies to function properly are constantly taking place within us. Thinking, learning, exercising, feeling happy or sad, putting on too much weight or not gaining enough, and virtually all life processes are made possible by these chemical reactions. Everything that we ingest is part of a complex process that determines whether our bodies work effectively or not. The consumption of some substances can initiate chemical reactions that will stop body functions altogether. Other substances, if consumed, can cause permanent handicaps, and still others can make living less comfortable. A proper balance of the right foods provides the chemicals and generates the reactions we need in order to function at our best. The knowledge of chemistry that you will soon be gaining will help you better understand how your body works so that you will be able to take proper care of it.

I Changing Times

We live in a world of increasingly rapid change. It has been said that the only constant is change itself. At present, we are facing some of the greatest problems that humans have ever encountered, and the dilemmas with which we are now confronted seem to have no perfect solutions. We are sometimes forced to make a best choice among only bad alternatives, and our decisions often provide only temporary solutions to our problems. Nevertheless, if we are to choose properly, we must understand what our choices are. Mistakes can be costly, and they cannot always be rectified. It is easy to pollute, but cleaning up pollution once it is there is enormously expensive. We can best avoid mistakes by collecting as much information as possible before making critical decisions. Science is a means of gathering and evaluating information, and chemistry is central to all the sciences.

I Chemistry and the Human Condition

Above all else, our hope is that you will learn that the study of chemistry need not be dull and difficult. Rather, it can enrich your life in so many ways—through a better understanding of your body, your mind, your environment, and the world in which you live. After all, the search to understand the universe is an essential part of what it means to be human.

Brief Contents

| | |
|--|-------|
| Contents | vii |
| Preface | xvii |
| To the Student | xxiii |
| 1 Chemistry: A Science for All Seasons | 3 |
| 2 Atoms: Are They for Real? | 33 |
| 3 Atomic Structure: Images of the Invisible | 47 |
| 4 Nuclear Chemistry: The Heart of Matter | 75 |
| 5 Chemical Bonds: The Ties That Bind | 107 |
| 6 Names, Formulas, and Equations: The Language of Chemistry | 141 |
| 7 Acids and Bases: Please Pass the Protons | 179 |
| 8 Oxidation and Reduction: Burn and Unburn | 195 |
| 9 Organic Chemistry: The Infinite Variety of Carbon Compounds | 219 |
| 10 Polymers: Giants Among Molecules | 251 |
| 11 Chemistry of the Earth: Metals and Minerals | 277 |
| 12 Air: The Breath of Life | 297 |
| 13 Water: Rivers of Life; Seas of Sorrows | 325 |
| 14 Energy: A Fuels Paradise | 349 |
| 15 Biochemistry: A Molecular View of Life | 389 |
| 16 Food: Those Incredible Edible Chemicals | 425 |
| 17 Household Chemicals: Helps and Hazards | 481 |
| 18 Fitness and Health: Some Chemical Connections | 513 |
| 19 Drugs: Chemical Cures, Comforts, and Cautions | 537 |
| 20 Poisons: Chemical Toxicology | 587 |
| Appendices | |
| A The International System of Measurement | A-1 |
| B Exponential Notation | A-3 |
| C Solving Problems by Unit Conversions | A-7 |
| D Significant Figures | A-13 |
| E Glossary | A-17 |
| F Answers | A-29 |
| Photo Credits | C-1 |
| Index | I-1 |

Contents

Preface xvii
To the Student xxiii

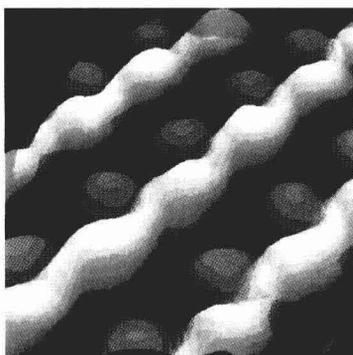
1 Chemistry *A science for All seasons* 3



| | | |
|------|--|----|
| 1.1 | Science and Technology: The Roots of Knowledge | 4 |
| 1.2 | The Baconian Dream | 5 |
| 1.3 | The Carsonian Nightmare | 6 |
| 1.4 | Science: Testable, Explanatory, and Tentative | 7 |
| 1.5 | What Science Cannot Do | 7 |
| 1.6 | Science and Technology: Risks and Benefits | 9 |
| 1.7 | Chemistry: A Study of Matter and Energy | 10 |
| 1.8 | The States of Matter | 14 |
| 1.9 | Matter: Pure Substances and Mixtures | 15 |
| 1.10 | The Measurement of Matter | 17 |
| 1.11 | Measuring Energy: Temperature and Heat | 20 |
| 1.12 | Density | 22 |
| 1.13 | Chemistry: Its Central Role | 22 |
| 1.14 | Solving Society's Problems: Applied Research | 24 |
| 1.15 | In Search of Knowledge: Basic Research | 24 |

Summary 28 • Key Terms 280 • Review Questions 29
Problems 30 • Projects 31 • References and Readings 31

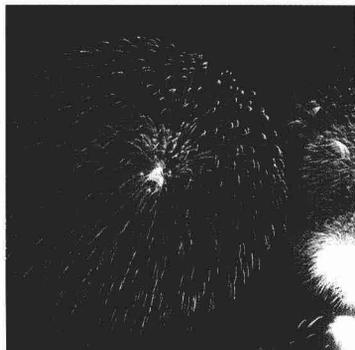
2 Atoms *Are They for Real?* 33



| | | |
|-----|---|----|
| 2.1 | Atoms: The Greek Idea | 33 |
| 2.2 | Lavoisier: The Law of Conservation of Mass | 34 |
| 2.3 | Proust: The Law of Definite Proportions | 35 |
| 2.4 | John Dalton and the Atomic Theory of Matter | 37 |
| 2.5 | Out of Chaos: The Periodic Table | 40 |
| 2.6 | Atoms: Real and Relevant | 41 |
| 2.7 | Leucippus Revisited: Molecules | 42 |

Summary 42 • Key Terms 43 • Review Questions 43
Problems 44 • References and Readings 45

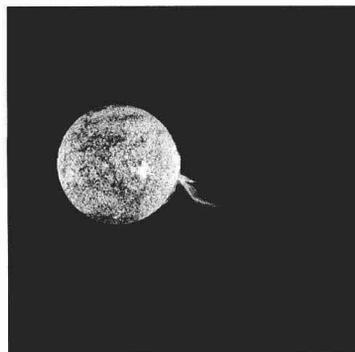
3 Atomic Structure *Images of the Invisible* 41



- 3.1 Electricity and the Atom 48
- 3.2 Serendipity in Science: X-Rays and Radioactivity 52
- 3.3 Three Types of Radioactivity 53
- 3.4 Rutherford's Experiment: The Nuclear Model of the Atom 54
- 3.5 The Structure of the Nucleus 56
- 3.6 Electron Arrangement: The Bohr Model 57
- 3.7 The Quantum Mechanical Atom 63
- 3.8 Electron Configurations and the Periodic Table 66
- 3.9 Which Model to Choose? 69

Summary 69 • Key Terms 70 • Review Questions 70
Problems 72 • References and Readings 73

4 Nuclear Chemistry *The Heart of Matter* 75

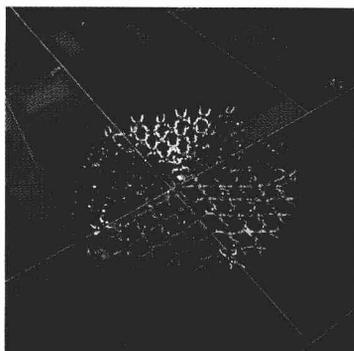


- 4.1 A Partial Parts List for the Atomic Nucleus 75
- 4.2 Nuclear Arithmetic: Symbols for Isotopes 76
- 4.3 Natural Radioactivity: Nuclear Equations 78
- 4.4 Half-Life 79
- 4.5 Artificial Transmutation 81
- 4.6 Induced Radioactivity 82
- 4.7 Penetrating Power of Radiation 83
- 4.8 Uses of Radioisotopes 84
- 4.9 Nuclear Medicine 86
- 4.10 Radioisotopic Dating 89
- 4.11 Einstein and the Equivalence of Mass and Energy 91
- 4.12 The Building of the Bomb 9
- 4.13 Radioactive Fallout 95
- 4.14 Nuclear Winter 97
- 4.15 Nuclear Power Plants 97
- 4.16 Radiation and Us 98
- 4.17 Binding Energy 99
- 4.18 Thermonuclear Reactions 100
- 4.19 The Nuclear Age 101

Summary 101 • Key Terms 102 • Review Questions 102
Problems 103 • Additional Problems 104 • Projects 104
References and Readings 105

5 Chemical Bonds *The Ties That Bind* 107

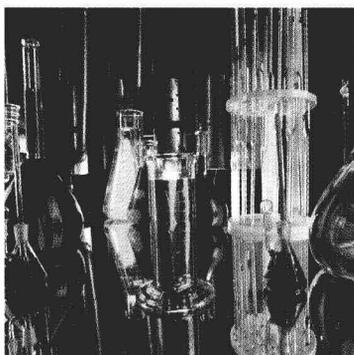
- 5.1 The Art of Deduction: Stable Electron Configurations 107
- 5.2 Electron-Dot Structures 109
- 5.3 Chemical Symbolism 110
- 5.4 Sodium Reacts with Chlorine: The Facts 110



| | | |
|-------------|---|-----|
| 5.5 | Sodium Reacts with Chlorine: The Theory | 111 |
| 5.6 | Using Electron-Dot Symbols: More Ionic Compounds | 112 |
| 5.7 | Covalent Bonds: Shared Electron Pairs | 114 |
| 5.8 | Unequal Sharing: Polar Covalent Bonds | 115 |
| 5.9 | Polyatomic Molecules: Water, Ammonia, and Methane | 117 |
| 5.10 | Multiple Bonds | 118 |
| 5.11 | Rules for Writing Electron-Dot Formulas | 118 |
| 5.12 | Exceptions to the Octet Rule | 123 |
| 5.13 | Molecular Shapes: The VSEPR Theory | 124 |
| 5.14 | Shapes and Properties: Polar and Nonpolar Molecules | 127 |
| 5.15 | Bonding Forces and the States of Matter | 129 |
| | Summary | 134 |
| | Key Terms | 135 |
| | Review Questions | 135 |
| | Problems | 136 |
| | Additional Problems | 138 |
| | References and Readings | 139 |

6 Names, Formulas, and Equations

The Language of Chemistry 141



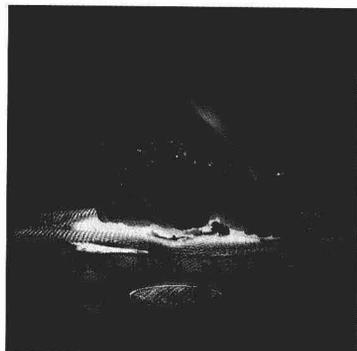
| | | |
|-------------|--|-----|
| 6.1 | Names and Symbols for Simple Ions | 141 |
| 6.2 | Formulas and Names of Binary Ionic Compounds | 143 |
| 6.3 | Polyatomic Ions | 145 |
| 6.4 | Names of Covalent Compounds | 148 |
| 6.5 | Chemical Sentences: Equations | 149 |
| 6.6 | Volume Relationships in Chemical Equations | 152 |
| 6.7 | Avogadro's Number: 6.02×10^{23} | 154 |
| 6.8 | The Mole: "A Dozen Eggs and a Mole of Sugar, Please" | 156 |
| 6.9 | The Gas Laws | 160 |
| 6.10 | Mole and Mass Relationships in Chemical Equations | 165 |
| | Summary | 171 |
| | Key Terms | 172 |
| | Review Questions | 172 |
| | Problems | 173 |
| | Additional Problems | 176 |
| | Project | 176 |
| | References and Readings | 177 |

7 Acids and Bases *Please Pass the Protons* 179



| | | |
|------------|---|-----|
| 7.1 | Acids and Bases: Experimental Definitions | 179 |
| 7.2 | Acids Explained: Hydronium Ions | 180 |
| 7.3 | Bases Explained: Hydroxide Ions | 182 |
| 7.4 | Strong and Weak Acids and Bases | 184 |
| 7.5 | The pH Scale | 186 |
| 7.6 | Acid Rain | 188 |
| 7.7 | Antacids: A Basic Remedy | 188 |
| 7.8 | Acids, Bases, and Human Health | 190 |
| | Summary | 191 |
| | Key Terms | 191 |
| | Review Questions | 191 |
| | Problems | 192 |
| | Projects | 193 |
| | References and Readings | 193 |

8 Oxidation and Reduction *Burn and Unburn* 195



- 8.1** Oxygen: Abundant and Essential 196
- 8.2** Hydrogen: Lightweight and Reactive 198
- 8.3** Oxidation and Reduction: Three Definitions 200
- 8.4** Oxidizing and Reducing Agents 204
- 8.5** Electrochemistry: Cells and Batteries 205
- 8.6** Corrosion 208
- 8.7** Explosive Reactions 209
- 8.8** Some Common Oxidizing Agents 210
- 8.9** Some Reducing Agents of Interest 211
- 8.10** Oxidation, Reduction, and Living Things 213

Summary 214 • Key Terms 214 • Review Questions 215
 Problems 215 • Additional Problems 216
 References and Readings 216

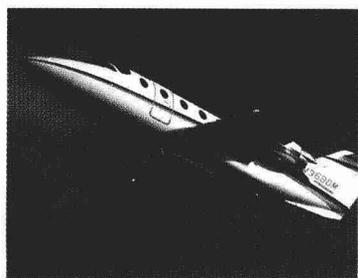
9 Organic Chemistry *The Infinite Variety of Carbon Compounds* 219



- 9.1** The Unique Carbon Atom 219
- 9.2** Simple Hydrocarbons: Alkanes 219
- 9.3** Cyclic Hydrocarbons: Rings and Things 225
- 9.4** Unsaturated Hydrocarbons: Alkenes and Alkynes 226
- 9.5** Aromatic Hydrocarbons: Benzene and Relatives 227
- 9.6** Chlorinated Hydrocarbons: Many Uses, Some Hazards 229
- 9.7** The Functional Group 230
- 9.8** The Alcohol Family 233
- 9.9** Phenols 236
- 9.10** Ethers 236
- 9.11** Aldehydes and Ketones 238
- 9.12** Organic Acids 240
- 9.13** Esters: The Sweet Smell of RCOOR' 241
- 9.14** Amines and Amides: Nitrogen-Containing Organics 243
- 9.15** Heterocyclic Compounds: Alkaloids and Others 244

Summary 245 • Key Terms 246 • Review Questions 246
 Problems 247 • Additional Problems 248
 References and Readings 249

10 Polymers *Giants Among Molecules* 251



- 10.1** Polymerization: Making Big Ones Out of Little Ones 251
- 10.2** Natural Polymers 251
- 10.3** Celluloid: Billiard Balls and Collars 252
- 10.4** Polyethylene: From the Battle of Britain to Bread Bags 252
- 10.5** Addition Polymerization: One + One + One . . . Gives One! 254
- 10.6** Rubber 260
- 10.7** Condensation Polymers: Splitting Out Water 262
- 10.8** Properties of Polymers 266
- 10.9** Disposal of Plastics 268

- 10.10** Plastics and Fire Hazards 269
10.11 Plasticizers and Pollution 269
10.12 Plastics and the Future 271

Summary 272 • Key Terms 272 • Review Questions 273
 Problems 273 • Additional Problems 274 • Projects 275
 References and Readings 275

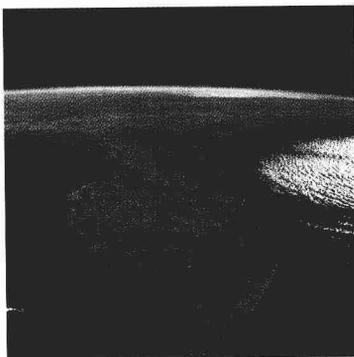
11 Chemistry of the Earth *Metals and Minerals* 277



- 11.1** Spaceship Earth: What It Is Made Of 277
11.2 The Lithosphere: Organic and Inorganic 278
11.3 Meeting Our Needs: From Sticks to Bricks 278
11.4 Silicates and the Shapes of Things 280
11.5 Modified Silicates: Ceramics, Glass, and Cement 282
11.6 Metals and Ores 284
11.7 Running Out of Everything: Earth's Dwindling Resources 288
11.8 Land Pollution: Solid Wastes 289
11.9 The Three R's of Garbage: Reduce, Reuse, Recycle 290
11.10 How Crowded Is Our Spaceship? 291

Summary 293 • Key Terms 293 • Review Questions 293
 Problems 294 • References and Readings 295

12 Air *The Breath of Life* 297



- 12.1** Atmosphere: Divisions and Composition 297
12.2 The Nitrogen Cycle 298
12.3 The Oxygen Cycle 299
12.4 Temperature Inversion 299
12.5 Natural Pollution 300
12.6 The Air Our Ancestors Breathed 301
12.7 Pollution Goes Global 301
12.8 Coal + Fire → Industrial Smog 302
12.9 The Chemistry of Industrial Smog 303
12.10 What to Do About Industrial Smog 304
12.11 Photochemical Smog: Making Haze While the Sun Shines 306
12.12 Carbon Monoxide: The Quiet Killer 306
12.13 Nitrogen Oxides: Some Chemistry of Amber Air 307
12.14 Ozone: Protector and Pollutant 308
12.15 Chlorofluorocarbons and Other Threats to the Ozone Shield 310
12.16 Hydrocarbons: Another Problem 311
12.17 What to Do About Photochemical Smog 311
12.18 Acid Rain: Air Pollution → Water Pollution 312
12.19 We Got the Lead Out 313
12.20 The Inside Story: Indoor Air Pollution 314
12.21 Who Pollutes? How Much? 315
12.22 Carbon Dioxide and Global Warming 317
12.23 The Ultimate Pollutant: Heat 318
12.24 Paying the Price 319

Summary 319 • Key Terms 320 • Review Questions 320
 Problems 321 • Additional Problems 322
 Projects 322 • References and Readings 322

13 Water *Rivers of Life; Seas of Sorrows* 325



- 13.1 Water: Some Unusual Properties 325
- 13.2 Water, Water, Everywhere 327
- 13.3 The Water Cycle 328
- 13.4 Biological Contamination: The Need for Clean Water 329
- 13.5 Chemical Contamination: From Farm, Factory, and Home 331
- 13.6 Natural Water Isn't All H₂O 331
- 13.7 Sewage: Some Chemistry and Biology 332
- 13.8 Ecological Cycles 333
- 13.9 Groundwater Contamination: Tainted Tap Water 335
- 13.10 Acid Waters: Dead Lakes 336
- 13.11 Industrial Water Pollution 337
- 13.12 Wastewater Treatment Plants 339
- 13.13 Back to the Soil: An Alternative Solution 341
- 13.14 A Drop to Drink 341
- 13.15 You're the Solution to Water Pollution 344

Summary 345 • Key Terms 345 • Review Questions 345
 Problems 346 • Additional Problems 346 • Projects 347
 References and Readings 347

14 Energy *A Fuels Paradise* 349



- 14.1 Heavenly Sunlight Flooding the Earth with Energy 349
- 14.2 Energy and Chemical Reactions 351
- 14.3 Energy and the First Law: Energy Is Conserved, Yet We're Running Out 353
- 14.4 Energy and the Second Law: Things Are Going to Get Worse 353
- 14.5 People Power: Early Uses of Energy 354
- 14.6 Fossil Fuels 355
- 14.7 Coal: The Carbon Rock of Ages 356
- 14.8 Natural Gas: Mostly Methane 359
- 14.9 Petroleum: Liquid Hydrocarbons 360
- 14.10 The Fossil Fuel Feast: A Brief Interlude 365
- 14.11 Convenient Energy: Electricity 366
- 14.12 Nuclear Power 367
- 14.13 Nuclear Fusion: The Sun in a Magnetic Bottle 372
- 14.14 Harnessing the Sun: Solar Energy 373
- 14.15 Biomass: Photosynthesis for Fuel 375
- 14.16 Other Energy Sources 377
- 14.17 Energy: How Much Is Too Much? 382