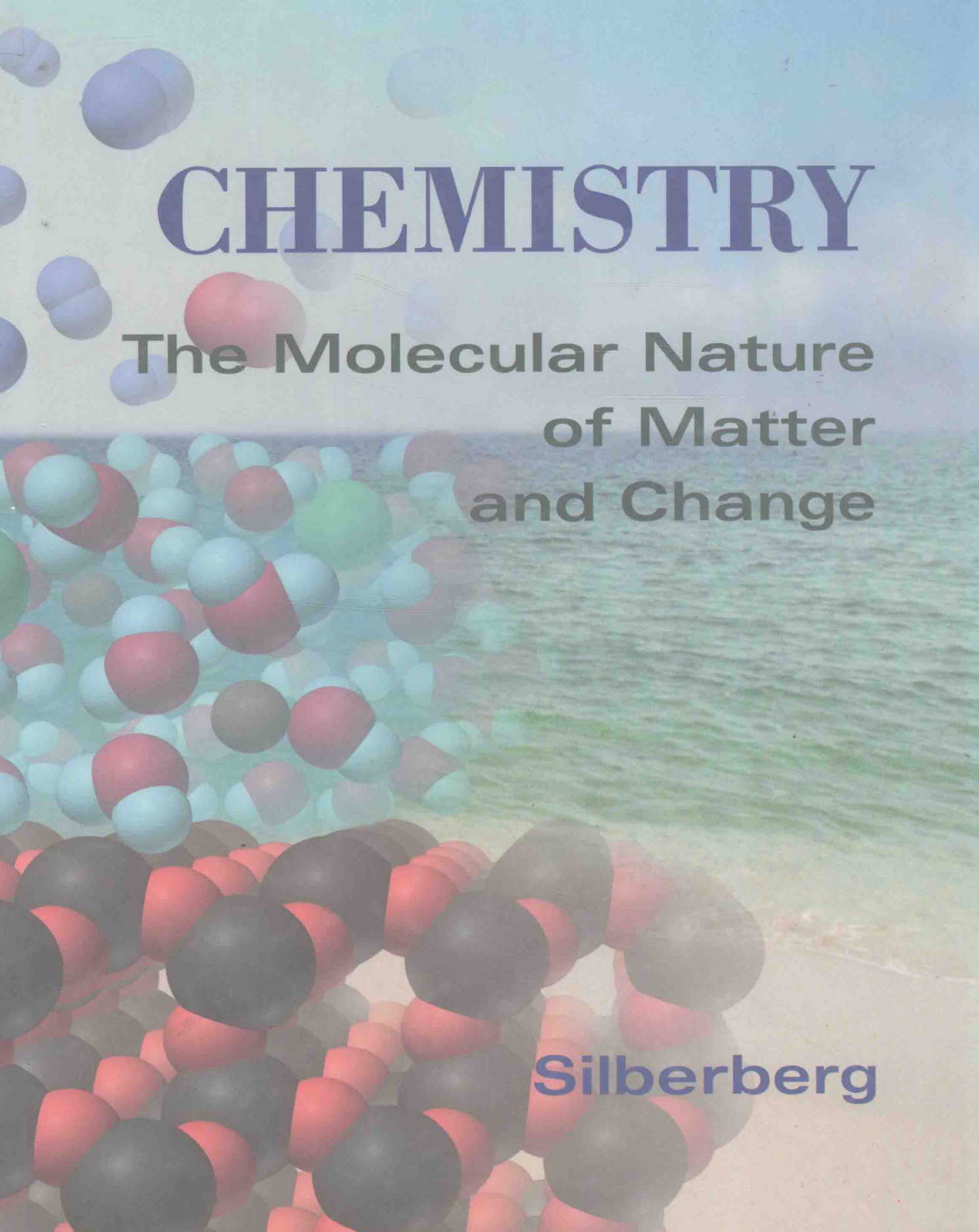

CHEMISTRY

The Molecular Nature of Matter and Change

Silberberg

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Martin Silberberg

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To Ruth,
my co-author in all things,
with deepest love and gratitude

To Daniel,
my sunshine, who makes me happy
when skies are gray

and
To the memory of Arne,
whose standards of excellence
inspire my every effort

Preface

No matter what your future plans in science, chemistry is one of the most exciting and useful subjects you will ever take. A chemistry course holds a three-part challenge for you while it offers a three-part reward:

- The first part is to train your mind to visualize molecular events. Everything that occurs in the observable world—from cooking an egg to digesting it, from mining aluminum ore to opening the finished soda can, from ozone depletion to curing disease—has its basis in the unobservable world of atoms and molecules. Inconceivably small objects moving at fantastic speeds populate this molecular realm, and they interact in remarkable ways to create the everyday world around and within you. To understand any material event requires the ability to picture molecular interactions.
- The second part is to develop a logical approach to solving problems—gathering necessary information, reasoning toward a conclusion, and then testing and revising it until the problem is solved, or at least clarified. This approach is the essence of science and, in fact, of most of life's endeavors. It is indispensable to performing well in this course and in any science-related career.
- The third part is to apply the principles you learn to real-world processes. Chemistry lies at the core of natural science and has essential connections to virtually every other one. The practical relevance of its concepts will help you make informed decisions on issues ranging from personal health and lifestyle to global warming and energy conservation, and it will enlighten you about how soap works, why a cave forms, what the stars are made of, and innumerable other facts. One thing is certain: a chemistry course will always give you an answer to "why is this material relevant?"

In some ways, taking this course is like traveling abroad: both provide an exciting journey, and both require a good guidebook to lead you through unfamiliar territory. The book should provide a close-up view of the customs of the land and its inhabitants; it should resolve confusion about traditions and laws by showing you how to solve any problems you may encounter; and it should help you relate new experiences to those you've already had, so you can understand both more deeply.

The challenge of the journey is yours. Here are some of the ways that this text, serving as your guidebook, can help you meet the challenge and reap the rewards of the course.

Visualizing the Models of Chemistry

The subtitle of the text refers to the fact that matter and its changes are ultimately molecular in nature. Text discussions and illustrations work together to emphasize this theme. Models are explained to you clearly at the observable level and then from a close-up, molecular point of view, and the accompanying illustrations depict substances side-by-side at these two levels of reality. Some figures show a reaction in photos as you might see it in the lab and magnify the view to the molecular scene. Others portray a molecular view at various points on a graph so you can imagine the events that occur along the mathematical curve.

Through the latest advances in computer graphics and chemical-information software, the book includes accurate depictions of molecules and crystals, with atoms color-coded by element. A new standard of realism is depicted with watery-looking water, shiny metals, and translucent atoms. Color consistency enhances your ability to organize concepts by always showing energy as yellow, heat orange, metals blue, and so forth. The main groups of the periodic table are also colored consistently, and three-dimensional periodic tables highlight key trends among properties. In fact, the art program is so conceptual that one way to study would be to review tables, figures, and figure legends.

This interplay between words and art helps you learn to magnify scenes in your imagination, as chemists do, and to picture invisible matter in terms of colliding spheres, twisting bonds, and crystal lattices. Such mental images improve comprehension by bridging the mind-boggling gap in size between the events you see and those that cause them.

Thinking Logically to Solve Problems

Chemistry may not be an easy "A," but if you develop a sound approach to thinking through an idea and solving problems, you *will* do well. The text provides several ways to help you develop this approach.

Explanations that build upon previous ideas. Many of the central concepts of chemistry form a logical sequence that build upon one another, and the text takes advantage of this hierarchy of ideas at every opportunity. Once you know that matter cannot be created or destroyed, the text applies this idea to balancing equations and calculating reaction yields. Once you know that opposite charges attract, the text shows how this fact explains why atoms bond and why gases condense to liquids. Once you understand the arrangement of electrons in an atom, the text shows how this arrangement gives rise to molecules with characteristic shapes. The discussions consistently emphasize the logical flow of ideas and interconnection of topics, as do several of the features described later. Moreover, the art includes summary diagrams that build related ideas into one overview illustration.

A four-step method for solving problems. Wherever an important new skill or concept is introduced, a worked-out sample problem appears.

A four-step approach is used to facilitate your reasoning, not memorizing, toward a solution: **plan, solve, check, practice.**

- *Plan.* After the problem is stated, the steps are verbally planned to show how to move from what is known to what is unknown. In early chapters or when a common type of problem is introduced, a detailed block diagram summarizes the steps in the plan.
- *Solve.* Next, the plan is executed by naming each calculation step and then carrying out the math. By planning how to solve the problem *before* you start pushing calculator buttons, you are far more likely to get the correct answer.
- *Check.* The next step is to check that the answer makes sense both chemically and mathematically. In many cases, a rough calculation appears to confirm the answer. It's easy to make an error in a complex problem, so checking is a very useful habit to form. Sometimes, a *Comment* appears about common pitfalls, alternative approaches, or interesting sidelights.
- *Practice.* A follow-up problem that requires the same concept to solve it appears immediately after the sample problem, and a brief, worked-out solution is provided at the end of the chapter.

A wide range of chapter problems. The end-of-chapter problems provide a large amount of additional practice. *Concept review questions* test your general understanding of key ideas in the chapter. *Skill-building exercises* are written in pairs, with one of each pair answered at the back of the book, so you have an identical problem with which to test yourself. To build your confidence, these exercises begin simply and increase gradually in difficulty. Then, *problems in context* apply the skills you've learned to interesting scenarios and examples. These three types of problems, which are keyed by chapter section, are followed by a group of *comprehensive problems* that are presented in any order and include problems from every section and often call on concepts and skills you learned in earlier chapters.

Applying Ideas and Skills to the Real World

No other science is as central to your everyday life as chemistry. Virtually every product of modern society undergoes at least one chemical process before it reaches you, and every natural process, both within and outside you, is governed by chemical principles. Numerous examples of this relevance are woven throughout the text discussions, but several features highlight it.

- *Boxed essays.* Two types of essays are placed throughout the text. To show you the interdisciplinary nature of chemistry and to address some of your possible career goals, Chemical Connections essays relate a principle under discussion to a major topic in another scientific field, including physiology, geology, engineering, and environmental science. To help you realize that models depend on careful measurements, Tools of the Chemistry Laboratory essays describe key instruments and techniques in the modern practice of chemistry.
- *Margin notes.* Short, interesting sidelights that relate directly to the topic you are reading appear in the margin throughout the book often accompanied by a figure. Topics range from the composition of beeswax to a biography of Albert Einstein to the atmosphere of Jupiter.
- *Galleries* are illustrated summaries that show how molecules and products in everyday life relate to chemical principles. You'll see how motor oils

and ball-point pens work, how flashlight and car batteries differ, and why gas bubbles are round and sweat cools you, as well as many other interesting applications of chemical principles.

Aids for Study and Review

You and your professor are not alone in wanting you to learn chemistry and do well in the course. The text has been designed to help you master the concepts and skills of chemistry in every way possible. In fact, there is help wherever you look. Take a moment to examine the parts of the book and the makeup of a typical chapter:

- *The parts of the book.* Chances are you will refer to the periodic table and alphabetical list of the elements on *the inside front cover* of the book many times throughout the course. Scan the *detailed table of contents* to get a clear sense of the topics covered, and don't be concerned if your professor rearranges the order; the topic sequence is quite flexible. Next appears a complete list of *highlighted figures and tables,* by chapter and page (more about these shortly), with data tables in colored type.

  Following the body of the text are three *appendices.* One reviews some basic mathematical operations used in chemistry. The second presents a large set of important data on the elements and compounds. The third provides answers to selected problems. Finally, a *glossary* provides you with definitions of every bold-faced term and offers another way to confirm your comprehension of a chapter. Use the *index* as the surest way of finding a particular item and those associated with it. *Inside the back cover* are tables of important physical constants, some common unit-conversion factors, and a list of figures and tables, with page number, that contain frequently used data.
- *The parts of a chapter.* Every chapter opens with a *chapter outline* of the main section titles for you to get a feel for the upcoming topics, followed by a list of *concepts and skills to review* from earlier chapters that are required to understand the chapter coming up. The introductory paragraphs include a brief overview of the topic sequence to prepare you again for what's ahead and help you place it in the context of what you've already learned. As you read through the text, note the *bold-faced terms* and their nearby definitions, *italicized points to remember,* and the *numbered equations.* The *figure legends* were written to restate and reinforce concepts, so be sure to read them. Take special note of *highlighted figures and tables,* those with a partial purple border to make them stand out. Either they contain data you will need frequently or they depict a key concept you may need to review later. Follow along carefully with the steps in a *sample problem,* and try to work the *follow-up problem* right away to be sure you've understood the ideas. As soon as you finish a section, the key points are reviewed in a *section summary.* A closing *chapter perspective* orients you to the main purpose of the chapter relative to upcoming chapters. A section for *review and reference* follows that includes key (bold-faced) terms by section, key (numbered) equations and relationships by page, answers (actually brief solutions) to the follow-up problems, and a list of sample problem titles by page. The *chapter problems* follow, with reference to relevant sample problems. Green-numbered problems are answered at the back of the book. Practice by doing as many problems as you can.

An Overview of the Chapter Content

Your professor will be especially pleased about the flexibility of chapter topics that make up the text. The main order follows a time-honored, logical sequence that covers, in four blocks of chapters, basic concepts, atomic and molecular structure, dynamic aspects of chemical change, and certain special topics. But there are innovative treatments in each chapter as well as some novel approaches to the chemistry of the elements and to two of the most popular topics in the course, organic chemistry and biochemistry. Glance at the table of contents as you look over the following rundown on the content of the book.

Chapters 1-6: Chemical fundamentals. The first block of chapters introduces the science of chemistry and covers some of the concepts and skills that you'll use throughout the course. You'll learn about the equation "sentences" of chemistry, the make-up of the atmosphere, why bread is less fattening than peanut butter, and the latest approaches to renewable energy. Topics include

- The origins of chemistry, scientific units and their interconversion in calculations, and the central place of chemistry in everyday life
- The historical development of understanding atomic structure, an introduction to chemical bonding in the context of the periodic table, and the chemical language of compound names and formulas
- Balancing equations and the quantitative relationships between amount and mass of a substance
- A first look at the characteristic behavior of elements and compounds in a survey of the types and essential nature of chemical reactions
- The behavior of gases and the molecular model that explains it
- The all-important relationship between heat and chemical change

If you've had a good high-school course, many of these topics may already be familiar, so you can use this block of chapters to review and consolidate these important ideas. Don't be concerned, however, if you haven't taken an earlier course: the text begins at the beginning and assumes *no* previous work in chemistry.

Chapters 7-12: Atomic and molecular structure. The second block of six chapters covers one of the central themes in chemistry—how physical and chemical properties of substances emerge from the properties of their component atoms and molecules. Each chapter in this block builds upon the previous one. You'll see how carbon and lead are similar and different, how your sense of smell works, why diamond is hard, and why there is nothing else in the universe with the remarkable properties of water. Topics include

- The development of quantum theory and its application to modern atomic structure
- The electronic structure of the atoms and how element properties recur throughout the periodic table
- The major types of chemical bonding, their basis in atomic properties, and their manifestation in the properties of substances
- A more extensive treatment of covalent bonding and the central importance of molecular shape
- How atomic properties and molecular shape influence the structure and physical properties of liquids and solids
- How the forces between molecules affect the properties of solutions

A novel approach to the descriptive chemistry of the elements. Learning how the elements and their compounds actually look and behave

makes the models that predict their properties come alive. Also, learning a core of ideas several times in different contexts solidifies that knowledge. Few topics in chemistry are more important than the periodic table and the chemistry of the elements and their compounds. While these topics appear in many places throughout the text, Chapters 2, 4, 8, the Interchapter, 13, 14, 22, and 23 include sections devoted especially to the various aspects of this topic. The Interchapter and Chapters 13, 14, and 23 are unique, so they require further description.

The Interchapter is a conceptual overview. Through concise text and numerous summarizing illustrations, a unique conceptual overview called Interchapter: A Mid-Course Perspective on the Properties of the Elements reviews major points from Chapters 7-12 and previews their relevance to upcoming material. You or your professor may refer to the Interchapter at this point in the course or at many other times—its content is universally applicable.

Chapter 13 applies principles to all the main-group elements. Through a group-by-group presentation that exemplifies principles from the previous six chapters, you'll study the smoothly changing patterns of element behavior. Illustrated "Family Portraits" summarize atomic, physical, and chemical properties of each group, while accompanying essays examine key trends in behavior and focus on especially important elements. Your professor has great flexibility in how and when to cover all or part of this material.

Chapter 14 grounds organic chemistry in atomic properties. In a novel approach to an exciting field, you'll see the marvelously diverse chemistry of organic and biological compounds arise inevitably from the atomic nature of carbon and a handful of its bonding partners. Names, structures, and reaction patterns of organic compounds are described, with reference to similar compounds of other elements and emphasis on the enormous molecules in polymers and organisms. As in the case of Chapter 13, your professor can cover all or part of this material at many points in the course.

Chapter 23 applies principles to the practical chemistry of the elements. This chapter repeats the approach of Chapter 13 in applying principles from the previous block of chapters to the behavior of the elements, but with a different emphasis and organization. Chapter 23 applies principles of kinetics, equilibrium, and thermodynamics to geological, environmental, and industrial topics. You'll see how the elements became distributed in the young Earth, how they cycle through the environment, and how we extract and use them.

Chapters 15-20: Dynamic aspects of chemical change. The third block of six chapters covers the central theories of physical chemistry that govern all reactions and have innumerable practical applications. You'll see how enzymes function, why ozone is becoming depleted, what we can do about acid rain, and why batteries run down. Topics include

- The field of chemical kinetics, which examines the speed of reactions, the molecular pathways they follow, and the action of catalysts
- The reversibility of all reactions, which relates directly to the extent of the chemical change: the first of three chapters on the nature of equilibrium emphasizes simple gaseous systems; the second deals with acids and bases; and the third examines other aqueous systems
- The thermodynamic driving force behind all reactions and the connection between a reaction and the work we can obtain from it

Special topics: Chapters 21-23. A final block of three chapters covers certain applied topics. You'll learn about the use of isotopes in medical diagnosis, the chemical steps in creating a photograph, the energy advantage of recycling aluminum cans, and how the elements form during the life cycle of a star. Topics include

- Reactions of the atomic nucleus with applications to medicine, engineering, and many other fields.
- The chemistry of the transition elements—a large group of metals, some of which are very familiar—and the unique types of compounds they form
- The industrial and environmental aspects of the chemical elements

Integration of biochemistry. The chemistry of living things fascinates everyone. Therefore, instead of waiting until the end of the course to cover biochemistry in a final, often-skipped chapter, the text employs some of the central ideas of biochemistry to exemplify concepts throughout the chapters, in discussions, margin notes, and Chemical Connections essays. The function of the biological macromolecules and their structures as extensions of simple organic compounds occupies a major portion of Chapter 14. Other discussions explore the importance of molecular shape in our senses of smell and sight, the role of solubility in the structure of cell membranes and the action of antibiotics, the relation of equilibrium to metabolic control, the electrochemical processes in cells, and many more themes.

A Final Word

On both the everyday and molecular levels, the world of matter and its changes is a remarkable place. By all means, let yourself be amazed by what you learn and curious about all there is still left to learn. Have a wonderful journey—and don't forget to write to let the publisher and author know how to improve the text for those coming after you!

Martin Silberberg

Martin Silberberg received his B.S. in Chemistry from the City University of New York in 1966 and his Ph.D. in Chemistry from the University of Oklahoma in 1971. He then accepted a research positon at the Albert Einstein College of Medicine in New York City, where, in collaboration with scientists from Rockefeller University, he studied the chemical nature of neurotransmission and Parkinson's disease.

Following a desire to teach, in 1977 Dr. Silberberg joined the faculty of Simon's Rock College of Bard (Massachusetts), a liberal arts college known for its excellence in teaching small classes of highly motivated students. As Head of the Natural Sciences Major and Director of PreMedical Studies, he taught courses in general chemistry, organic chemistry, biochemistry, and nonmajors chemistry. This close student contact afforded him insights into how students learn chemistry, where they have difficulties, and what strategies can help them succeed.

In 1983, Dr. Silberberg decided to apply these insights in a broader context and established a college-text writing and editing company. Before writing his own text, he worked on college physics, chemistry, and biochemistry texts for several major academic publishers. He resides with his wife and child in the Berkshire Mountains of western Massachusetts, where he enjoys the rich musical life of the area, bakes bread, and chases woodchucks from his vegetable garden.

L. Peter Gold grew up in Massachusetts and obtained his undergraduate and graduate education at Harvard University. He is Professor of Chemistry at The Pennsylvania State University where he has been since 1965. During that time he has taught general chemistry (to over ten thousand students) as well as physical chemistry and physical chemistry lab. His hobbies include music, both as a performer and a listener, computers, and omnivirous reading.

Charles Haas, emeritus Professor of Chemistry at the Pennsylvania State University, earned his Ph.D. at the University of Chicago under the supervision of Norman Nachtrieb. During his thirty-seven year career at Penn State he taught general chemistry, undergraduate and graduate inorganic chemistry, and courses in chemical education for public school teachers at all levels. He was honored with both the College of Science Noll Award and the University Amoco Award for teaching. His research focus is on transition metals chemistry and the stability of coordination compounds. Since his retirement he has spent much of his time reading and traveling worldwide.

Dr. Robert Loeschen earned a B.S. in Chemistry from the University of Illinois and a Ph.D. from the University of Chicago. He joined the faculty at California State University Long Beach in 1969. Trained as an organic chemist, he teaches a wide variety of courses, including general chemistry for science majors, chemistry for nursing majors (he co-authored a text for this subject), organic chemistry for nonmajors, organic chemistry for majors, and occasionally a graduate course in his research specialty, organic photochemistry. At present, he spends half his time in the chemistry department and half of his time as Associate Dean for the College of Natural Sciences and Mathematics. When he is not teaching or deaning he plays golf or putters in his woodworking shop.

Arian Norman conducted undergraduate studies at the University of North Dakota, graduate work at Indiana University, and postdoctoral research at the University of California (Berkeley); he is a Distinguished Alumnus from the University of North Dakota. Dr. Norman is Professor of Chemistry and Biochemistry at the Unviersity of Colorado (Boulder) where he has taught general and inorganic chemistry for the past 29 years, concentrating on the teaching of molecular graphics, modeling, and visualization techniques. He is a main-group element synthetic chemist, with research interests in structure/activity relationships and new materials applications of phosphorus compounds for which he has been awarded Alfred P. Sloan and University of Colorado Council of Research and Creative Work fellowships. Professor Norman is an avid cyclist and Nordic skier; most recently, he cycled across Italy.

A Complete Package of Instructional Supplements

Several ancillary materials have been prepared to assist you and your professor in making your learning experience as complete as possible:

For the Student

Student Study Guide, by Elizabeth Weberg. This extensive study guide covers the most important points in every chapter of the text. Clearly formatted

and illustrated, it develops concepts and skills in a friendly, relaxed style that forestalls student confusion. The guide contains numerous worked-out examples, key points to keep in mind, and a large number of additional problems (with answers) for self-test purposes.

Student Solutions Manual, coauthored by Martin Silberberg. This manual contains complete worked-out solutions to all follow-up problems and half of all the chapter problems. Each chapter of solutions opens with a summary of the text-chapter content and a list of key equations needed to solve the problems.

Laboratory Manual, This manual includes clear descriptions of 30 experiments, including pre-lab assignments, that accommodate a wide range of equipment and stress laboratory safety. An instructor's resource guide is available to accompany the manual.

Molecules 3D: Molecular Modeling Software, by Mosby and Molecular Arts Corporation. This powerful and innovative, yet inexpensive, software for Windows and Macintosh incorporates an expandable library of more than 100 structures to allow construction of virtually any molecule for 3D examination. It also allows conversion of Lewis structures to molecular shapes at the click of a button.

For the Professor

Instructor's Resource Manual coauthored by Martin Silberberg. This manual, also available on disc, contains discussions of chapter purpose and approach, alternative topic sequences (including specific ways to further integrate descriptive chemistry), chapter outlines, and suggestions for video lecture demonstrations and student reading.

Instructor's Solutions Manual by Alan J. Pribula, Frank Milio, and Thomas Berg, Towson State University. This manual contains worked-out solutions for all chapter problems in the text.

Test Bank by Dennis R. Flentge, Cedarville College. This resource contains 1500 multiple-choice questions organized by chapter, with every choice based on actual student responses to exam questions.

ESATEST III Computerized Testing System by Engineering Software Associates. This state-of-the-art test generation software, available for IBM (DOS and Windows) and Macintosh, offers an impressive array of features, including a two-track design (Easytest for the novice and Fulltest for the expert); ability to import text and graphics; and test generation by question number, topic, and formula. The Mosby version of ESATEST III contains all questions in the Test Bank plus all chapter problems from the textbook, thus offering the most complete set of digitally editable problems available.

Transparency Acetates and Slides. These resources contain full-color reproductions of 254 figures from the text.

Chemical Videodisc. Available in standard videotape format, this disc includes most of the photographs and all of the line art from the text, in addition to 40 lecture demonstrations for your course and numerous animations of chemical phenomena.

View-Study Image Disc for General Chemistry. Available free to adopters, and for a small fee to students, this unique new CD-ROM software for Windows and Macintosh includes a database of artwork and photographs with accompanying captions from the text. Cross-referenced by topic, concept, and figure number, this tool allows students to print items on notecard or full-size format for review and note taking, and allows instructors to show images and create transparencies and illustrated exam materials.

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Writing a text of this scope is both a humbling experience and a daunting task. Thankfully, numerous talented people helped, and their collective efforts have greatly improved the final result.

First and foremost, I was privileged to have worked with four professors with whom I consulted throughout the project—Peter Gold, Chuck Haas, Bob Loeschen, and Arlan Norman. Sitting together, we forged the shape of each chapter and, in the subsequent written drafts, their seemingly limitless understanding of chemical ideas and facts has informed every page. I cannot thank them enough for their contributions to the project. Knowing they were there, in steadfast support of my efforts, made the task a lot easier.

In addition to the consultants, a large number of professors and other scientific professionals played important roles in the project. Their contributions of time and experience have added immeasurably to the relevance and accuracy of the text. It is important to me that all of them know that every effort was made to incorporate their suggestions. The following is an alphabetical list of reviewers:

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At Mosby, I found a publisher with a commitment to the highest standards of quality and the expertise to bring those standards to fruition. My admiration and gratitude go first to Jim Smith, who acquired the project. Jim is one of a noble breed of editors who actually reads the chapters because he loves the subject matter and who always puts education of the student first. I regard Jim as an inspiration and friend. Lloyd Black, the chemistry editor, came late to the project but has energized the ancillaries and provided the resolve to maintain the high standards throughout the final stages.

There is no way to express how fortunate I am to have had Judy Hauck as the managing editor of the project. With her rare combination of creativity, intelligence, and skill, Judy made numberless editorial and production decisions. She coordinated the artwork, enhanced the design, and organized the ancillaries, all the while remaining warm and humane. Her commitment to quality and her generous support of the book and its often-frazzled author have made, to the extent that such a thing is possible, the final 18 months of this project an enjoyable experience. I will be ever grateful.

Special thanks go to Donata Dettbarn, who pleasantly received my amorphous requests for images and then searched persistently, sometimes around the globe, to obtain an outstanding group of photos, and to David Shaw, who made innumerable final adjustments to the figures and was instrumental in the design and execution of the galleries.

The production team at Mosby produced an exceptionally beautiful book, and I am very appreciative of their efforts. John Rogers managed the complex production of the text; Chris Murphy, the production editor, always responded calmly and efficiently to a grinding schedule and an obsessive author; Renée Duenow produced the handsome book design; and Roger McWilliams copyedited the manuscript.

The marketing team at Mosby, led for my project by Rhonda Rogers, developed an exciting program for presenting the book to the educational community, including a handsome, informative brochure, salesperson training sessions, and a prospectus of sample chapters.

As every author of such an undertaking knows, words of thanks, no matter how effusive, become crumbs in the face of the debt one owes to all the members of one's family. Their tireless patience with my seemingly endless self-involvement, together with their unstinting belief in me, has been an invaluable gift. Daniel was born early in the first draft, and his boundless enthusiasm and cheerfulness have quite literally helped me make it through to the end. Now that he is six, I will at last have the time for guiltless play, and I can't wait!

In the beginning, there was only Ruth. Her vast experience in editing and production imprints the entire book. We thought through the overall theme and how to manifest it, the individual ideas and how to present them, the features and how to design them. Ruth was there to help with whatever needed fixing, from the clarity of an explanation to the design of a figure. She typed the problems, cropped the photos, created the page layout, and checked the page proofs. But most important of all, she still looks at me with a sparkle in her eyes.

Martin Silberberg