Preface

In this new millenium, as the world faces new and extreme challenges, the importance of acquiring a solid foundation in chemical principles has become increasingly important to understand the challenges that lie ahead. Moreover, as the world becomes more integrated and interdependent, so too do the scientific disciplines. The divisions between fields such as chemistry, physics, biology, environmental sciences, geology, and materials science, among others, have become less clearly defined. The goal of this text is to address the increasing close relationship among various disciplines and to show the relevance of chemistry to contemporary issues in a pedagogically approachable manner.

Because of the enthusiasm of the majority of first-year chemistry students for biologically and medically relevant topics, this text uses an integrated approach that includes explicit discussions of biological and environmental applications of chemistry. Topics relevant to materials science are also introduced to meet the more specific needs of engineering students. To facilitate integration of such material, simple organic structures, nomenclature, and reactions are introduced very early in the text, and both organic and inorganic examples are used wherever possible. This approach emphasizes the distinctions between ionic and covalent bonding, thus enhancing the students' chance of success in the organic chemistry course that traditionally follows general chemistry.

The overall goal is to produce a text that introduces the students to the relevance and excitement of chemistry. Although much of first-year chemistry is taught as a service course, there is no reason that the intrinsic excitement and potential of chemistry cannot be the focal point of the text and the course. We emphasize the positive aspects of chemistry and its relationship to students' lives, which requires bringing in applications early and often. Unfortunately, one cannot assume that students in such courses today are highly motivated to study chemistry for its own sake. The explicit discussion of biological, environmental, and materials issues from a chemical perspective is intended to motivate the students and help them appreciate the relevance of chemistry to their lives. Material that has traditionally been relegated to boxes, and thus perhaps perceived as peripheral by the students, has been incorporated into the text to serve as a learning tool.

To begin the discussion of chemistry rapidly, the traditional first chapter introducing units, significant figures, conversion factors, dimensional analysis, and so on, has been reorganized. The material has been placed in the chapters where the relevant concepts are first introduced, thus providing three advantages: it

eliminates the tedium of the traditional approach, which introduces mathematical operations at the outset, and thus avoids the perception that chemistry is a mathematics course; it avoids the early introduction of operations such as logarithms and exponents, which are typically not encountered again for several chapters and may easily be forgotten when they are needed; and third, it provides a review for those students who have already had relatively sophisticated high school chemistry and math courses, although the sections are designed primarily for students unfamiliar with the topic.

Our specific objectives include the following:

1. To write the text at a level suitable for science majors, but using a less formal writing style that will appeal to modern students.
2. To produce a *truly* integrated text that gives the student who takes only a single year of chemistry an overview of the most important subdisciplines of chemistry, including organic, inorganic, biological, materials, environmental, and nuclear chemistry, thus emphasizing unifying concepts.
3. To introduce fundamental concepts in the first two-thirds of the chapter, then applications relevant to the health sciences or engineers. This provides a flexible text that can be tailored to the specific needs and interests of the audience.
4. To ensure the accuracy of the material presented, which is enhanced by the author's breadth of professional experience and experience as active chemical researchers.
5. To produce a spare, clean, uncluttered text that is less distracting to the student, where each piece of art serves as a pedagogical device.
6. To introduce the distinction between ionic and covalent bonding and reactions early in the text, and to continue to build on this foundation in the subsequent discussion, while emphasizing the relationship between structure and reactivity.
7. To utilize established pedagogical devices to maximize students' ability to learn directly from the text. These include copious worked examples in the text, problem-solving strategies, and similar unworked exercises with solutions. End-of-chapter problems are designed to ensure that students have grasped major concepts in addition to testing their ability to solve numerical, problems. Problems emphasizing applications are drawn from many disciplines.
8. To emphasize an intuitive and predictive approach to problem solving that relies on a thorough understanding of key concepts and recognition of important patterns rather than on memorization. Many patterns are indicated throughout the text as notes in the margin.

The text is organized by units that discuss introductory concepts, atomic and molecular structure, the states of matter, kinetics and equilibria, and descriptive inorganic chemistry. The text breaks the traditional chapter on liquids and solids into two to expand the coverage of important and topics such as semiconductors and superconductors, polymers, and engineering materials.

In summary, this text represents a step in the evolution of the general chemistry text toward one that reflects the increasing overlap between chemistry and other disciplines. Most importantly, the text discusses exciting and relevant aspects of biological, environmental, and materials science that are usually relegated to the last few chapters, and it provides a format that allows the instructor to tailor the emphasis to the needs of the class. By the end of Chapter 6 "The Structure of Atoms", the student will have already been introduced to environmental topics such as acid rain, the ozone layer, and periodic extinctions, and to biological topics such as antibiotics and the caloric content of foods. Nonetheless, the new material is presented in such a way as to minimally perturb the traditional sequence of topics in a first-year course, making the adaptation easier for instructors.