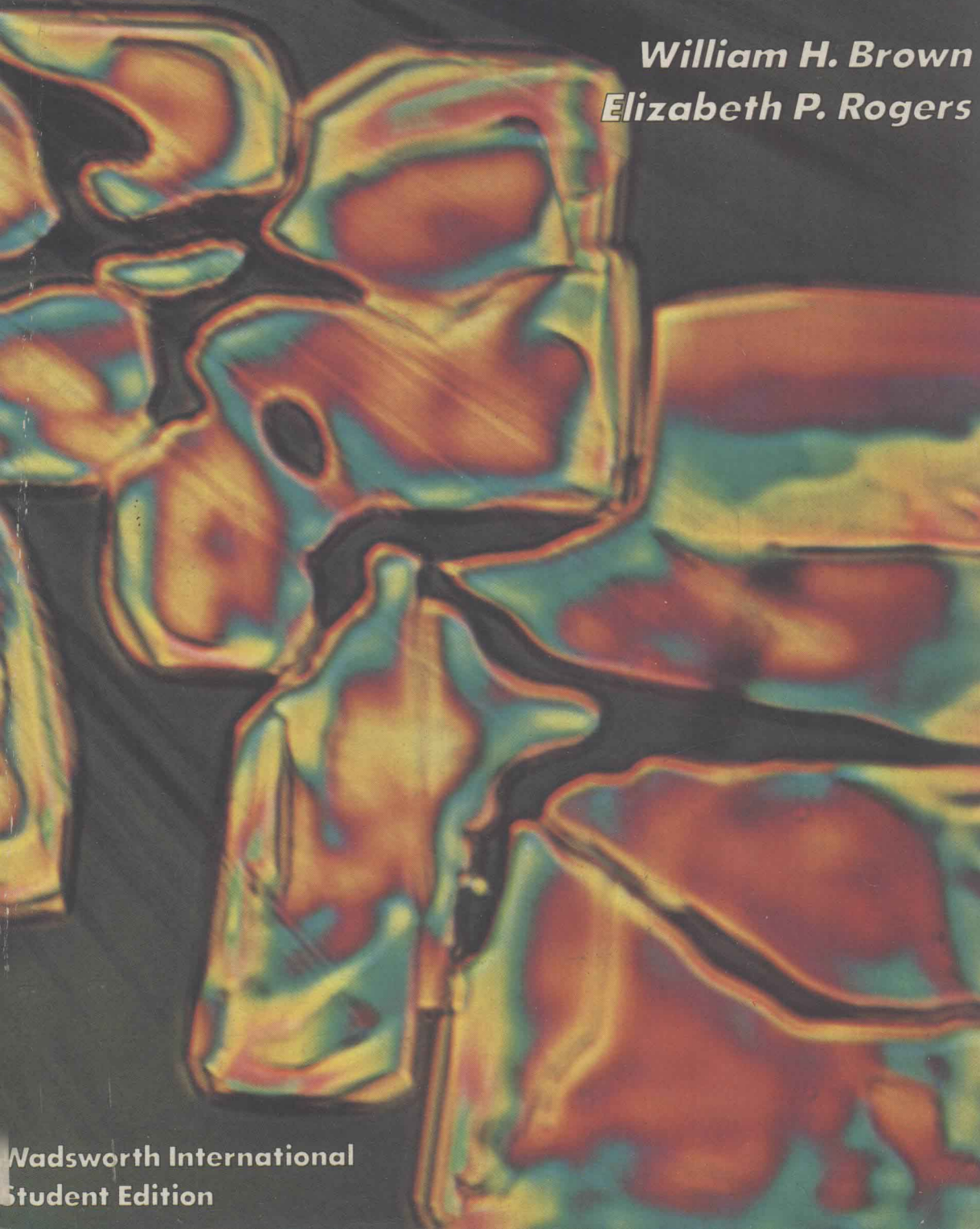
GENERAL, ORGANIC AND BIOCHEMISTRY

William H. Brown
Elizabeth P. Rogers



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GENERAL, ORGANIC AND BIOCHEMISTRY

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The photo shows a crystal obtained by allowing a common buffer solution (see p. 274) to evaporate. The useful pH range of hepes buffer is 6.8-8.2.

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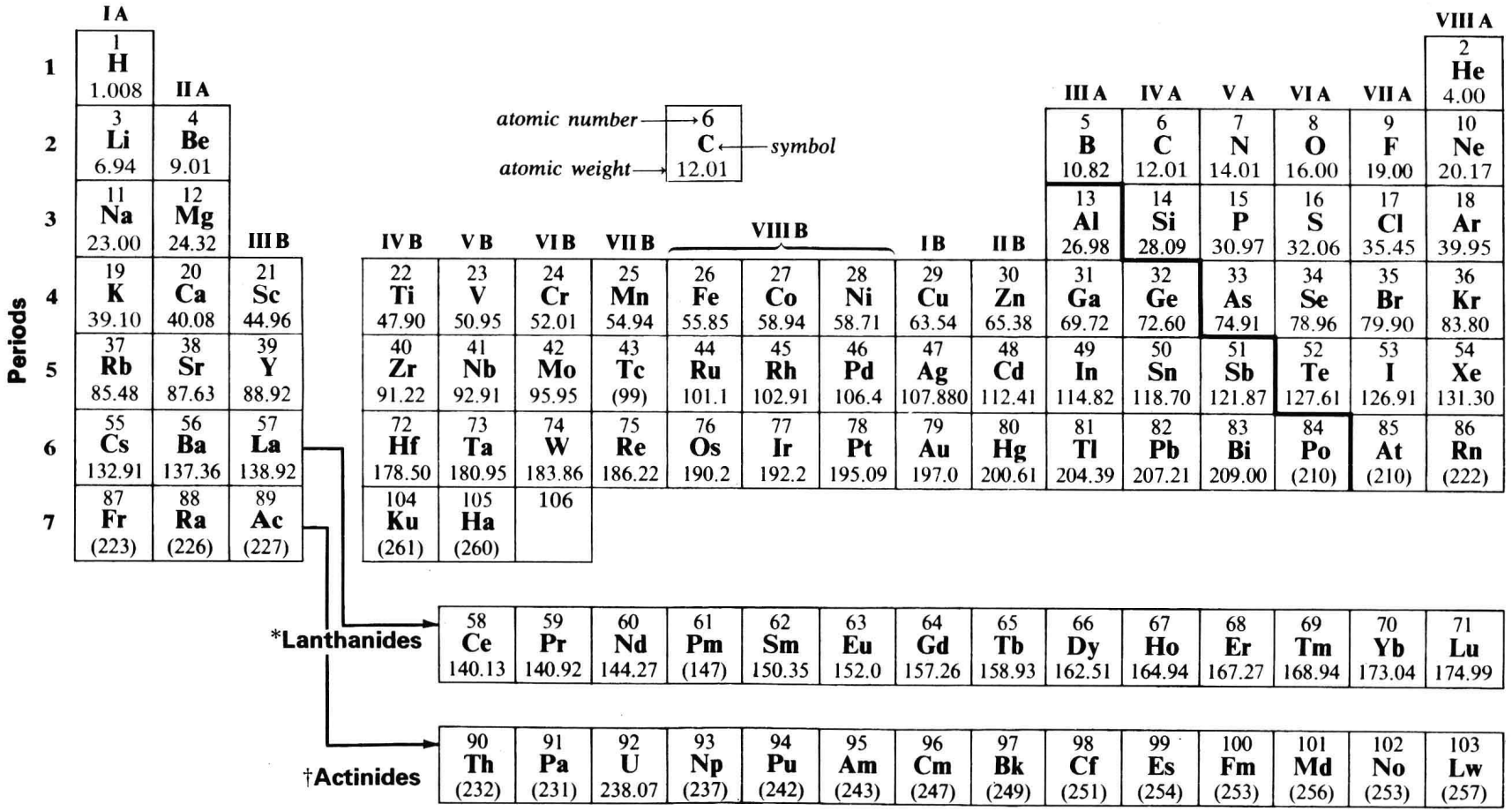
Periodic Table of the Elements



PREFACE

Our text is written for students interested in the life sciences, particularly those planning careers in one of the many health professions. While these students are not training to become professional chemists, they do need to understand how the functioning of living systems depends on chemistry. In this survey of general, organic, and biochemistry, we have tried to reveal this relationship and provide the necessary chemical foundation for further study in the life sciences.

The category of life science students includes a large variety of academic majors. Although all these students need a knowledge of chemistry, some need to know more about certain areas of chemistry than about others. An inhalation therapist, for instance, needs to know more about the behavior and properties of gases than does a physical education major; and a radiation technologist requires a greater background in radiochemistry than does a dietician. These diverse needs impose some special requirements on a text.

First, the book must contain a wide choice of material from which instructors can tailor courses to fit their particular groups of students. For example, some teachers, but not all, will cover topics such as specific heat or the chemistry of alkynes. For this reason we have included more material than most courses will cover, and have left to each individual instructor the final decision on topic selection. Subjects that might not be included in all sequences are discussed in free-standing sections, generally placed at the ends of chapters.

Second, the organization of the text must be flexible enought so that the topics selected may be presented in an order that is most logical for that group. Our text is organized in a way that seems logical to us, but we realize that other approaches will work equally well. For this reason we have divided chapters into many sections to give the instructor as much latitude as possible in arranging the material to be covered. Nuclear chemistry, for example, is included at the end of Chapter 2 because it follows logically after the discussion of atomic structure. However, these sections can just as logically be presented later.

Finally, as a result of the first two requirements, topics must be presented so that the information flows evenly regardless of the arrangement. We have tried to be consistent in both the manner and level of presentation, neither slighting one topic nor going overboard on another. New terms are introduced carefully and are always accompanied by a clear definition. Each chapter concludes with a summary of important terms and concepts, including reactions where appropriate. Models are used to explain microscopic phenomena on a macroscopic scale, and we have chosen examples from everyday life to illustrate new or complex concepts.

Special attention has been given to quantitative calculations and problem solving, since this area is often a stumbling block for beginning students. Unit or dimensional analysis is introduced in the first chapter, along with a system students can use to analyze problems, identify the necessary data, and arrange it in solvable form. Once presented, we stay with this approach throughout the book. Since learning to solve quantitative problems is not always a quick process, we have spaced the introduction of each new type of problem so that the student has a chance to get a firm grasp on it before another kind is introduced.

Example problems with step-by-step solutions appear within chapters. Each example is always followed by a similar in-chapter problem for the student to solve. Answers to all in-chapter problems are found at the back of the book. Many more problems are included at the end of each chapter, progressing from review of important terms and necessary drill exercises to more challenging questions. Solutions to end-of-chapter problems marked with a ★ are contained in the Study Guide.

A word should be said about the mini-essays, which appear between chapters throughout the book. They have several purposes. First, they help make the connection between the study of chemistry and the vocational areas in which life science students are interested. For example, it may not be immediately evident to a nursing student why transition metals need to be studied. The essay on the role of trace elements in metabolism answers that question. Second, the mini-essays demonstrate some of the creative excitement inherent in chemistry, and they also offer a glimpse of the human involvement in research and discovery.

The first eight chapters of our text present the fundamental concepts of chemistry. Chapter 1 deals with quantitative measurement, problem solving by unit analysis, and physical properties that are useful in identifying substances. Chapters 2 and 3 concentrate on the atomic structure of matter, including radioactivity and the use of radioisotopes in medicine. Chapter 4 discusses compounds, their composition and their properties, with particular emphasis on bonding and geometry. Chemical reactions are covered in Chapter 5: equations, stoichiometry, and oxidation–reduction as a special category of chemical reaction are discussed. The kinetic theory of matter is presented in Chapter 6, showing how the behavior of individual molecules in a large collection of molecules can predict the properties of that sample. The properties of solutions and colloids are covered in Chapter 7, with a large section devoted to the stoichiometry of solutions. The introductory section of the text closes with a chapter presenting the collision theory of reactions and the implications of reversible reactions: namely, chemical equilibrium, the equilibrium constant, pH, and buffers.

Chapter 9 provides an overview of covalent bonding in organic compounds and introduces the concepts of structural and functional-group isomerism. Also presented are the hybridization of atomic orbitals and covalent bond formation by the overlap of atomic orbitals; however, instructors may omit this treatment of hybrid orbitals without affecting the remainder of the text.

Chapters 10–17 cover the structures and typical reactions of the important functional groups encountered throughout the remainder of the text. The next five chapters provide a comprehensive treatment of the structure and function of the key classes of biomolecules: carbohydrates, amino acids and proteins, enzymes, lipids, and nucleic acids.

Chapter 23 introduces the metabolism chapters with a discussion of the oxidation of foodstuffs and the central role of ATP in the transfer of energy in the

biological world. The metabolism of carbohydrates, fatty acids, and amino acids is presented in Chapters 24–26. Stressed is the fact that the metabolism of these foodstuff molecules is interrelated and precisely regulated.

Several ancillary aids are available with this text. For students, we have prepared a **Study Guide.** Each chapter in it corresponds to a text chapter and contains three parts: "Things to Study" directs the readers to important concepts, rules, and reactions; a "Self-Test" with answers allows students to test their mastery of the material; and "Solutions to Selected Problems," chosen from those at the end of each chapter, includes suggestions on how to develop a strategy for solving types of problem.

A **Laboratory Program** has been compiled by H.A. Neidig and J.N. Spencer of Lebanon Valley College and L.B. Clapp of Brown University. Experiments complement the material presented in the text and were selected with an eye on safety, cost, and the amount of bench time required. Every investigation has a pre-laboratory assignment designed to acquaint the student with the experiment *before* coming to lab. Complete information is available to instructors concerning the preparation and use of these experiments.

For the teacher, we have written an **Instructor's Guide.** It contains an overview of each chapter, pointing out the degree of flexibility, both in terms of material and organization. Two suggested course outlines, one for a sequence of approximately 40 lecture hours and one for 80, are included, along with solutions to all of the end-of-chapter problems.

Acknowledgments

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