Basic Concepts of Chemistry

second edition

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Preface

Basic Concepts of Chemistry is not only an introduction to chemical concepts but is also an introduction to the way chemistry is studied and mastered. The level, content, and sequence of topics have been chosen with a sensitivity to students who have had little or no background in chemistry or who have had a significant interruption in their studies of chemistry. The text is primarily for students who wish to obtain the background and confidence needed to pursue a main sequence chemistry course. It can also be used in the general chemistry part of a course for the allied health professions or for a one-time course in chemistry.

The style is conversational but concise. The traditional sequence of topics provides a step-by-step construction of the science, with one topic building logically on the previous one. It is understood that many, if not most, students using this book will require some mathematical preparation or review in the extensive quantitative concepts applied to chemical systems. The text is written with this very important fact in mind. The mathematical tools of measurement and conversions are presented in Chapter 2 and are supplemented by detailed reviews in the appendixes. The next five chapters introduce many basic chemical concepts that are not primarily mathematical in nature. However, in Chapter 8 the quantitative nature of chemistry becomes apparent with the introduction of the mole. In between Chapters 2 and 8, the students, with the direction of the instructor, are given an opportunity to improve their mathematical, algebraic, and problem-solving skills. There are separate appendixes on basic math (Appendix A), basic algebra (Appendix B), scientific notation (Appendix C), logarithms (Appendix E), and graphs (Appendix F). The appendixes include discussions, worked-out examples, and drill problems (with the answers provided). They are specially designed for application to the types of problems encountered in chemistry. Appendixes A, B, and C also include self-diagnostic tests so that students can easily determine the extent of review they need.

Almost all introductory and general chemistry textbooks now use the

unit-factor (dimensional analysis) method of problem solving. I believe, however, that the typical student, who is not familiar with this method, needs more than a one- or two-page introduction to apply this tool consistently and confidently. In Chapter 2, there is a detailed introduction to the topic, *supplemented* by an extensive appendix (Appendix D) that develops the unit-factor method step by step from the construction of conversion factors, to simple one-step conversions, to more complex multiple-step conversions. Solved example and exercise problems (with answers) are provided. Diligent students should become comfortable with this problem-solving method by the time it is applied extensively to chemical systems.

The book is designed with considerable flexibility in the sequence of topics and chapters. Many may prefer to cover moles and stoichiometry as early as possible. Hence, the instructor may proceed directly from Chapter 3 (after Section 3-5) to Chapter 8 and then to Section 9-3 on stoichiometry. I feel that it is preferable to present the topic of moles in a thorough manner, as is done in Chapter 8, instead of superficially introducing this topic in an early chapter without detailed, supporting explanations and examples.

There is obviously more material in this book than can be easily covered in a one-semester course. Generally, Chapters 1 to 10 would be covered, but there will be much variation in later chapters depending on the topics that the instructor wishes to emphasize. The nuclear discussion in Chapter 3 is completely optional: discussion and problems are separated from the rest of the chapter so they can be included at any time. This topic is included here because it follows logically from the discussion of the nature of the nucleus and is effective in building early interest regarding the popular concerns in this area. It can be omitted or included later. The discussions of orbitals and box diagrams in Chapter 4 are also optional and may be deleted without prejudice in later discussions.

Many other features of this book are designed to help students understand and organize the sequence of topics. The following is a list of these special features retained from the first edition of this text.

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1 Simple analogies are used that relate the concrete to the abstract. Analogies that are easily understood themselves can be helpful in making new concepts understandable.

2 Introductions to each chapter discuss the overall objectives of the chapter, how it follows from previous discussions and, most important, what specific topics previously discussed are relevant and should be reviewed. This approach emphasizes the continuity of chemistry as a subject where topics build one upon another.

3 Numerous example problems are worked out in the text, step by step. There are usually two or three examples of each type of problem with careful explanations of procedures.

4 End-of-chapter problems are assigned in the margins of the text after a particular topic has been discussed and examples are shown. This is designed to give students direction for the immediate reinforcement of a concept without affecting the continuity of the discussion.

5 End-of-chapter problems are numerous and of varying difficulty. They are categorized by topic. Over one half of the answers are provided in Appendix H (many of the quantitative problems include solutions).

6 New terms are introduced in boldface type. The definitions of the terms are in italics.

7 A comprehensive glossary of terms provides easy reference to the definitions used throughout the text.

The following are additions and other improvements that have been included in the second edition of the book.

1 The number of end-of-chapter exercises are nearly tripled.

2 A chapter purpose and a list of chapter objectives are included at the beginning of each chapter.

3 Chapter summaries are added that give a synopsis of the chapter by using tables, diagrams, and flow charts where appropriate.

4 Comprehensive review tests are added after Chapters 3, 7, 10, and 14. These are designed to integrate the material in the intervening chapters.

5 Chapters are extensively rewritten, and topics within the chapters have been reorganized for improved flow and clarity. Information of current interest is updated.

6 A chapter (Chapter 11) is added on the liquid and solid states of water and changes between states. Some other topics now covered in this text are: colligative properties (Chapter 12), specific heat (Chapter 2), and activation energy (Chapter 15). Two chapters on acid-base chemistry in the first edition are combined into one chapter (Chapter 13) in the second edition. All or parts of this chapter may be included depending on the depth of coverage desired.

7 Several additional study aid materials are now available. The Study Guide to accompany this text is rewritten to provide closer support. In the Study Guide, related sections within a chapter have been grouped for discussion and self-testing rather than the chapter as a whole. Some short stories of current interest are also included in the Study Guide. They stress how chemistry relates to the discoveries and progress in many other disciplines. An innovative, new laboratory manual, written

by Professors Steven Murov and Brian Stedjee, accompanies this text. Finally, excellent computer-assisted instructional software, prepared by Professor Frank P. Rinehart, is being made available to instructors of this course. It will help make the challenge of problem solving fun as well as satisfying. This software will supplement Chapter 9 Chemical Reactions and is one of a forthcoming series for Chemical Education.

I hope you find the study or the teaching of this course rewarding and that you sense the author's enthusiasm for this fascinating discipline.

Leo J . Malone

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The emergence of the human race from among the other animals can be traced to the use of fire.

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