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PREFACE

From the first edition, my aim has been to write a general chemistry text that provides a firm foundation in chemical concepts and principles and to instill in students an appreciation of the vital part chemistry plays in our daily life. It is the responsibility of the textbook author to assist both instructors and their students in their pursuit of this objective by presenting a broad range of topics in a logical manner. I have tried to strike a balance between theory and application and to illustrate basic principles with everyday examples whenever possible.

In this tenth edition, as in previous editions, my goal is to create a text that is clear in explaining abstract concepts, concise so that it does not overburden students with unnecessary extraneous information, yet comprehensive enough so that it prepares students to move on to the next level of learning. The encouraging feedback I have received from instructors and students has convinced me that this approach is effective.

What's New in This Edition?

- **NEW** to the chapters is Review of Concepts. This is a quick knowledge test for the student to gauge his or her understanding of the concept just presented. The answers to the Review of Concepts are available in the *Student Solutions Manual* and on the companion ARIS (Assessment, Review, and Instruction System) website.
- ***NEW*** are powerful connections to electronic homework. All of the practice exercises for the Worked Examples in all chapters are now found within the ARIS (Assessment, Review, and Instruction System) electronic homework system. Each end-of-chapter problem in ARIS is noted in the Electronic Homework Problem section.
- Many **NEW** end-of-chapter problems with graphical representation of molecules have been added to test the conceptual comprehension and critical thinking skills of the student. The more challenging problems are listed under the Special Problems section.
- **NEW** computer-generated molecular orbital diagrams are presented in Chapter 10.
- Many sections have been revised and updated based on the comments from reviewers and users. Some examples include:
  - — Revised the treatment of Amounts of Reactants and Products in Chapter 3.
  - — Revised the explanation of thermochemical equations in Chapter 6.
  - — Expanded coverage on effective nuclear charge in Chapter 8.
  - — Revised the treatment of orientation factor in Chapter 13.
  - — Revised the discussion of entropy in Chapter 18.
  - — Added a new Chemistry in Action (Boron Neutron Capture Therapy) in Chapter 23.

Problem Solving

The development of problem-solving skills has always been a major objective of this text. The two major categories of learning are the worked examples and end of chapter problems. Many of them present extra tidbits of knowledge and enable the student to solve a chemical problem that a chemist would solve. The examples and problems show students the real world of chemistry and applications to everyday life situations.

- **Worked examples** follow a proven step-by-step strategy and solution.
  - — **Problem statement** is the reporting of the facts needed to solve the problem based on the question posed.
  - — **Strategy** is a carefully thought-out plan or method to serve as an important function of learning.
  - — **Solution** is the process of solving a problem given in a stepwise manner.
  - — **Check** enables the student to compare and verify with the source information to make sure the answer is reasonable.
  - — **Practice Exercise** provides the opportunity to solve a similar problem in order to become proficient in this problem type. The Practice Exercises are available in the ARIS electronic homework system. The marginal note lists additional similar problems to work in the end-of-chapter problem section.

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- **End-of-Chapter problems** are organized in various ways. Each section under a topic heading begins with Review Questions followed by Problems. The Additional Problems section provides more problems not organized by sections. Finally, the Special Problems section contains more challenging problems.

Visualization

- **Graphs and Flow Charts** are important in science. In *Chemistry,* flow charts show the thought process of a concept and graphs present data to comprehend the concept.
- **Molecular art** appears in various formats to serve different needs. Molecular models help to visualize the three-dimensional arrangement of atoms in a molecule. Electrostatic potential maps illustrate the electron density distribution in molecules. Finally, there is the macroscopic-to-microscopic art, helping students understand processes at the molecular level.
- **Photos** are used to help students become familiar with chemicals and understand how chemical reactions appear in reality.
- **Figures of apparatus** enable the student to visualize the practical arrangement in a chemistry laboratory.

Study Aids

Setting the Stage

On the two-page opening spread for each chapter the chapter outline, Student Interactive Activity, and A Look Ahead appear.

- **Chapter Outline** enables the student to see at a glance the big picture and focus on the main ideas of the chapter.
- **Student Interactive Activity** shows where the electronic media are used in the chapter. A list of the animations, media player material, and questions in ARIS homework, as well as the questions with access to an electronic tutorial is given. Within the chapter, icons are used to refer to the items shown in the Student Interactive Activity list.
- **A Look Ahead** provides the student with an overview of concepts that will be presented in the chapter.

Tools to Use for Studying

Useful aids for studying are plentiful in *Chemistry* and should be used constantly to reinforce the comprehension of chemical concepts.

- **Marginal Notes** are used to provide hints and feedback to enhance the knowledge base for the student.
- **Worked Examples** along with the accompanying Practice Exercise is a very important tool for learning and mastering chemistry. The problem-solving steps guide the student through the critical thinking necessary for succeeding in chemistry. Using sketches helps student understand the inner workings of a problem. (See Example 6.1 on page 237.) A margin note lists similar problems in the end-of-chapter problems section, enabling the student to apply new skill to other problems of the same type. Answers to the Practice Exercises are listed at the end of the chapter problems.
- **Review of Concepts** enables the student to evaluate whether they understand the concept presented in the section. Answers to the Review of Concepts can be found in the *Student Solution Manual* and online in the accompanying ARIS companion website.
- **Key Equations** are highlighted within the chapter, drawing the student's eye to material that needs to be understood and retained. The key equations are also presented in the chapter summary materials for easy access in review and study.
- **Summary of Facts and Concepts** provides a quick review of concepts presented and discussed in detail within the chapter.
- **Key Words** are a list of all important terms to help the student understand the language of chemistry.

Testing Your Knowledge

- **Review of Concepts** lets the student pause and test his/her understanding of the concept presented and discussed in the section. Answers to the Review of Concepts can be found in the *Student Solution Manual* and online in the accompanying ARIS companion website.
- **End-of-Chapter Problems** enable the student to practice critical thinking and problem-solving skills. The problems are broken into various types:
  - — By chapter section. Starting with Review Questions to test basic conceptual understanding, followed by Problems to test the student's skill in solving problems for that particular section of the chapter.
  - — Additional Problems uses knowledge gained from the various sections and/or previous chapters to solve the problem.
  - — The Special Problem section contains more challenging problems that are suitable for group projects.

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Real-Life Relevance

Interesting examples of how chemistry applies to life are used throughout the text. Analogies are used where appropriate to help foster understanding of abstract chemical concepts.

- **End-of-Chapter Problems** pose many relevant questions for the student to solve. Examples include: Why do swimming coaches sometimes place a drop of alcohol in a swimmer's ear to draw out water? How does one estimate the pressure in a carbonated soft drink bottle before removing the cap?
- **Chemistry in Action** boxes appear in every chapter on a variety of topics, each with its own story of how chemistry can affect a part of life. The student can learn about the science of scuba diving and nuclear medicine, among many other interesting cases.
- **Chemical Mystery** poses a mystery case to the student. A series of chemical questions provide clues as to how the mystery could possibly be solved. Chemical Mystery will foster a high level of critical thinking using the basic problem-solving steps built-up throughout the text.

Instructor's Resources

ARIS (Assessment, Review, and Instruction System)

The *Assessment, Review, and Instruction System,* also known as ARIS, is an electronic homework and course management system designed for greater flexibility, power, and ease of use than any other system. Whether you are looking for a preplanned course or one you can customize to fit your course needs, ARIS is your solution.

In addition to having access to all student digital learning objects, ARIS enables instructors to build assignments and track student progress, and provides more flexibility.

Build Assignments

- Choose from prebuilt assignments or create your own custom content by importing your own content or editing an existing assignment from the prebuilt assignment.
- Assignments can include quiz questions, animations, and videos—anything found on the website.
- Create announcements and utilize full course or individual student communication tools.
- Assign questions developed following the problem-solving strategy used within the textual material, enabling students to continue the learning process from the text into their homework assignments in a structured manner.
- Assign algorithmic questions providing students with multiple chances to practice and gain skill at problem solving on the same concept.

Track Student Progress

- Assignments are automatically graded.
- Gradebook functionality enables full course management including:
  - — Dropping the lowest grades
  - — Weighting grades/manually adjusting grades
  - — Exporting your gradebook to Excel, WebCT, or BlackBoard
  - — Manipulating data, enabling you to track student progress through multiple reports

Offers More Flexibility

- **Sharing Course Materials with Colleagues**—Instructors can create and share course materials and assignments with colleagues with a few clicks of the mouse, allowing for multiple section courses with many instructors (and TAs) to continually be in sync if desired.
- **Integration with BlackBoard or WebCT**—once a student is registered in the course, all student activity within McGraw-Hill's ARIS is automatically recorded and available to the instructor through a fully integrated grade book that can be downloaded to Excel, WebCT, or BlackBoard.

Access to your book, access to all books! The Presentation Center library includes thousands of assets from many McGraw-Hill titles. This ever-growing resource gives instructors the power to utilize assets specific to an adopted textbook as well as content from all other books in the library.

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Presentation Center

Accessed from your textbook's ARIS website, **Presentation Center** is an online digital library containing photos, artwork, animations, and other media types that can be used to create customized lectures, visually enhanced tests and quizzes, compelling course websites, or attractive

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printed support materials. All assets are copyrighted by McGraw-Hill Higher Education, but can be used by instructors for classroom purposes. The visual resources in this collection include:

- **Art** Full-color digital files of all illustrations in the book can be readily incorporated into lecture presentations, exams, or custom-made classroom materials. In addition, all files are preinserted into PowerPoint slides for ease of lecture preparation.
- **Photos** The photos collection contains digital files of photographs from the text, which can be reproduced for multiple classroom uses.
- **Tables** Every table that appears in the text has been saved in electronic form for use in classroom presentations and/or quizzes.
- **Animations** Numerous full-color animations illustrating important processes are also provided. Harness the visual impact of concepts in motion by importing these files into classroom presentations or online course materials.
- **Media Player** The chapter summary and many animations can be downloaded to a media player for ease of study on the go.

Also residing on your textbook's ARIS website are

- **PowerPoint Lecture Outlines** Ready-made presentations that combine art and lecture notes are provided for each chapter of the text.
- **PowerPoint Slides** For instructors who prefer to create their lectures from scratch, all illustrations, photos, and tables are preinserted by chapter into blank PowerPoint slides.

Computerized Test Bank Online

A comprehensive bank of test questions, revised by Ken Goldsby (Florida State University), is provided within a computerized test bank enabling you to create paper and online tests or quizzes in this easy-to-use program. Imagine being able to create and access your test or quiz anywhere, at any time.

Instructors can create or edit questions, and drag-and drop questions to create tests quickly and easily. The test can be published automatically online to your course and course management system, or you can print them for paper-based tests.

The test bank contains over 2000 multiple-choice and short-answer questions. The questions, which are graded in difficulty, are comparable to the problems in the text.

Instructor's Solution Manual

The ***Instructor's Solution Manual*** is written by Brandon J. Cruickshank (Northern Arizona University) and Raymond Chang. The solutions to all of the end-of-chapter problems are given in the manual. The manual also provides the difficulty level and category type for each problem. This manual is online in the text's ARIS website.

The ***Instructor's Manual*** provides a brief summary of the contents of each chapter, along with the learning goals, reference to background concepts in earlier chapters, and teaching tips. This manual is online in the text's ARIS website.

Content Delivery Flexibility

Chemistry by Raymond Chang is available in many formats in addition to the traditional textbook to give instructors and students more choices when deciding on the format of their chemistry text. Choices include:

Color Custom by Chapter

For even more flexibility, we offer the Chang ***Chemistry*** text in a full-color, custom version that enables instructors to pick the chapters they want. Students pay for only what the instructor chooses.

Electronic Book

If you or your students are ready for an alternative version of the traditional textbook, McGraw-Hill can provide you innovative and inexpensive electronic textbooks. By purchasing E-books from McGraw-Hill, students can save as much as 50% on selected titles delivered on an advanced E-book platform.

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Primis LabBase

The Primis LabBase is by Joseph Lagowski (the University of Texas at Austin). More than 40 general chemistry experiments are available in this database collection of

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general lab experiments from the *Journal of Chemical Education* and experiments used by Professor Lagowski at the University of Texas at Austin, enabling instructors to customize their lab manuals.

Cooperative Chemistry Laboratory Manual

This innovative guide by Melanie Cooper (Clemson University) features open-ended problems designed to simulate experience in a research lab. Working in groups, students investigate one problem over a period of several weeks, so that they might complete three or four projects during the semester, rather than one preprogrammed experiment per class. The emphasis is on experimental design, analysis problem solving, and communication.

Student Resources

Designed to help students maximize their learning experience in chemistry—we offer the following options to students:

ARIS

ARIS (Assessment, Review, and Instruction System) is an electronic study system that offers students a digital portal of knowledge.

Students can readily access a variety of **digital learning objects** that include:

- chapter-level quizzing
- animations
- interactives
- Media Player downloads of selected content

Intelligent Tutors

Intelligent Tutors, powered by Quantum Tutors, provides real-time personal tutoring help for struggling and advanced students with step-by-step feedback and detailed instruction based on the student's own work. Immediate answers are provided to the student over the Internet, day or night, on topics including chemical reactions, chemical bonding, equation balancing, equilibrium, oxidation numbers, stoichiometry, and more. Intelligent Tutors can be accessed through the ARIS book site.

Student Solutions Manual

The *Student Solutions Manual* is written by Brandon J. Cruickshank (Northern Arizona University) and Raymond Chang. This supplement contains detailed solutions and explanations for all even-numbered problems in the main text. The manual also includes a detailed discussion of different types of problems and approaches to solving chemical problems and tutorial solutions for many of the end-of-chapter problems in the text, along with strategies for solving them.

Student Study Guide

This valuable ancillary by Kim Woodrum (University of Kentucky) contains material to help the student practice problem-solving skills. For each section of a chapter, the author provides study objectives and a summary of the corresponding text. Following the summary are sample problems with detailed solutions. Each chapter has true-false questions and a self-test, with all answers provided at the end of the chapter.

Schaum's Outline of College Chemistry

This helpful study aid by Jerome Rosenberg (Michigan State University) and Lawrence Epstein (University of Pittsburgh) provides students with hundreds of solved and supplementary problems for the general chemistry course.

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