

The background of the cover is an abstract composition of overlapping, angular shapes in shades of deep blue and bright yellow. The shapes resemble stylized, jagged paper or fabric folds, creating a sense of depth and movement. The yellow shapes are primarily on the left and top, while the blue shapes fill the right and bottom, with some areas of overlap and shadow.

FIFTH EDITION

**INTRODUCTION TO
CHEMISTRY**

T.R. DICKSON

INTRODUCTION TO CHEMISTRY

FIFTH EDITION

T.R. DICKSON

Cabrillo College

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INTRODUCTION TO CHEMISTRY

TO THE STUDENT: A Study Guide for the textbook is available through your college bookstore under the title Study Guide to accompany INTRODUCTION TO CHEMISTRY by T. R. Dickson. The Study Guide can help you with course material by acting as a tutorial, review and study aid. If the Study Guide is not in stock, ask the bookstore manager to order a copy for you.

This book is dedicated to the 5.5×10^3 students whom I have had the pleasure of teaching over the past 24 years.

PREFACE

This book is intended for a one-term course in chemistry. It presents the foundations of chemistry to students who need preparation for further study as well as to those who wish to take only an introductory course. The text presents a first course in chemistry, and no previous background in chemistry is assumed.

A preparatory course should provide students with an honest view of chemistry as a central science. This edition of the book is a product of more than 20 years of teaching, and it reflects my concern that the introductory course be one of the most important chemistry courses. The purpose of this book is to teach chemistry by providing a dynamic, interesting, and relevant view of matter and the environment. One of the main themes is to introduce, explain, and illustrate the problem-solving methods of beginning chemistry. Problem-solving skills are taught throughout the text. Approaches to solving chemical problems by reasoning and the unit-equation, factor-label, or dimensional-analysis methods are explained in detail and numerous examples are given. Pertinent examples, analogies, and special topics are used to introduce and illustrate chemical concepts.

This book is organized as follows:

- The chapters in the book are presented in a logical sequence, but the sequence can be altered according to the preferences of the instructor. The latter chapters include oxidation–reduction, liquids and solids, nuclear energy, organic chemistry, and biochemistry. These chapters are optional and are written so that any chapter or chapter section can be selected as desired.
- Major learning objectives and important terms are listed at the beginning of each chapter. They serve as a guide to student learning. You may choose to designate which objectives and terms you think are most important.
- Each chapter opens with a **CHEMICAL CONNECTIONS** section. These sections give brief descriptions of the content of the chapters. In addition, these sections tell which previous chapters contain material connected to the current chapter and which future chapters are related to the current chapter.
- Important new terms are denoted in the text with boldface type.

- Numerous definitions and ideas are emphasized by margin notes, drawings, and photographs.
- Mathematical tools and methods are introduced to the students as needed. They are dispersed within the text and are set off for emphasis.
- Mathematical methods, problem-solving methods, and the use of calculators are covered in the appendices.
- Special topics relating to current scientific and environmental concern are included at the end of several chapters.
- Most problems are written to include interesting topics and information so that students can relate to them.
- The end-of-chapter problems and questions are labeled to refer to various chapter sections.
- About one-half of the end-of-chapter problems have answers or solutions in the back of the book. Problems with answers or solutions are marked with asterisks.

This fifth edition has been rewritten with the intent of improving clarity and updating material. In many instances, greater emphasis has been placed on some important topics, and new examples and analogies have been included. Finally, the number of end-of-chapter problems has been nearly doubled to provide a wide choice of assignments.

The supplements designed to accompany this text are *Student Study Guide for Introduction to Chemistry*, Fifth Edition. This soft-cover book is designed to assist students in mastering concepts and developing problem-solving skills. It is keyed to the objectives of each chapter and contains helpful hints and a glossary of terms for each chapter. A practice exam is included for each chapter.

Laboratory Experiments for Introduction to Chemistry, Fifth Edition. This laboratory manual contains a variety of laboratory exercises sequenced to follow the chapters of the text. Each exercise has a report sheet and post-laboratory questions.

Transparency Masters. Instructors who adopt this book may obtain from Wiley, free of charge, a set of black and white drawings containing items that are keyed to the text.

Teachers Manual. Instructors who adopt this book may obtain a manual containing solutions to all of the end-of-chapter problems and questions in the text. A portion of this manual contains information about the experiments found in the laboratory manual. Equipment and chemical needs are listed along with sample laboratory report sheets and the solutions to all report questions.

Microcomputer Test Making Software for IBM PC and Apple IIe/IIC Computers. A test-making program, with question files that allows the user to use the computer to prepare exams and quizzes. This program can be obtained free of charge, from T. R. Dickson, Cabrillo College, Aptos, CA, 95003.

I am very grateful to all the students, teachers, and other individuals who have helped in the preparation of this fifth edition. Special thanks to Pat Blanchette for her typing and word processing skills and to Francine Genta for her help with the problems. In addition, I thank the following reviewers for their many helpful suggestions.

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NOTE TO STUDENTS

You are beginning the study of introductory chemistry. You will find this book to be a valuable source of information and a dependable guide to your study. This note describes what you will find in the book and gives you some suggestions for studying chemistry.

As you learn chemistry, you will encounter many new concepts and terms. Important terms and definitions are printed in boldface type for emphasis. A good way to enhance your learning is to read a chapter rather quickly and underline or note topics as you read. Then, you should reread the material more carefully and take notes on your reading, or make notes in the margin. An important part of the study of chemistry involves the learning of problem-solving skills. You will find many *worked out* examples in the text. These examples are intended to guide you through the techniques and methods of problem solving, and you will find them to be very helpful.

Objectives and Terms to Know

Each chapter opens with a list of learning objectives that describe the content of the chapter. Read the objectives and keep them in mind as you read the text. At the end of each chapter you will find a review of the objectives. This review refers you to chapter sections so that you can concentrate on an objective that needs further study.

You will also find a list of "Terms to Know" at the beginning of each chapter. These are fundamental terms that you need to learn as you develop your understanding of chemistry. Some terms have precise definitions that are emphasized in the text. Other terms are more general and require a general understanding. After reading a chapter, return to the list of Terms to Know and review them. Chapter sections in which you will find the terms are included in the list.

Chemical Connections

At the beginning of each chapter you will find a brief description of the contents of that chapter. In learning chemistry you will be introduced to basic principles and skills that you will need for further study. The "Chemical Connections" section of each chapter lists the topics that were discussed in earlier chapters that connect to the cur-

rent chapter. In addition, so that you can see why various concepts and skills are important and useful, future chapters directly related to the current chapter are listed. In brief, the Chemical Connections sections tell you where you are, where you have been, and where you are headed.

Help with Mathematics

In addition to learning concepts and terms, you will be learning important problem-solving skills. This book is designed to develop your problem-solving skills in several ways. As mentioned previously, various chapters contain problem-solving examples that are completely worked out and carefully explained. Important mathematical skills and concepts are described in the book as they are needed. For example, in Chapter 2 you will find a discussion of percentage and a discussion of exponential notation. In Chapters 1 and 3 you will find a discussion of the use of hand calculators. A hand calculator will not solve problems for you, but will be very useful for any arithmetic calculations.

Several appendices are placed at the end of the book for your reference. The topics included are

1. Mathematics Skills for Chemistry
2. Unit Equation and Problem Solving
3. Some Useful Conversion Factors
4. Using a Hand Calculator in Chemistry

Finding Information

Anytime you want to locate a topic or term in the text use the index located at the back of the book. Important terms within a chapter can be located by referring to the list of terms at the beginning of the chapter. A specific chapter section can be located by use of the Table of Contents or by use of the descriptive headings found on each *right-hand* page. Commonly used tables and lists are located inside the front and back covers for your convenience.

Studying Chemistry

Your instructor will assign various chapters or chapter sections for study. This book is designed so that some of the later chapters are optional and therefore may not be assigned. Furthermore, your instructor may choose to assign chapters in an order that is different from the sequence given in the book. This book is designed to allow the selection of different chapter sequences.

Some students find it useful to mark those chapter sections that

they believe they need to review and study more carefully. This can be done as you rather quickly read the chapter for the first time. When you return for a more careful reading you can concentrate on any topics that you have noted.

A variety of problems and questions are provided at the end of each chapter. You are not expected to answer all of them. Your instructor may assign some selected problems and questions or you may select specific problems and questions for practice. End of chapter questions and problems are listed by chapter section numbers. Use these references to locate any problems you want to use to practice your problem-solving skills. Those problems marked with an asterisk have answers in the back of the book.

The learning of terms and definitions can be aided by the use of flash cards or study lists. A useful technique is to make a list of terms so that the terms are located on the left-hand side of the paper and the definitions are located on the right-hand side. A blank piece of paper is then used to cover the right-hand side, and you can write the definitions from memory. As you write the definitions you can get a feel for each term, develop a picture of each in your mind, or hear them as you write. Here is an example. You have probably heard of the common chemical elements oxygen, iron, mercury, and lead. Each chemical element is referred to by special symbol. The symbols for these four elements are

oxygen	O
iron	Fe
mercury	Hg
lead	Pb

Study these for a moment. You may find that the best way to memorize these terms is to picture each name and symbol in your mind's eye so that you can develop a vivid image. To recall them, all you need to do is visualize the images and picture them on the page as you write them. On the other hand, you may find the best way to memorize these terms is to touch them and to trace them to get hold of them and grasp them in your mind. To recall them, just reach into your mind to get a feeling for them and write them down. As another option, you may find that the best way to memorize these terms is to speak them and to hear them so that you can tune into them with the ears of your mind. To recall them, just close your eyes and listen for each to be sounded out to you. For practice, memorize this short list of names and symbols to see which method or methods work best.

In your study of chemistry you will learn many new terms and skills. You will find that the material you learn and the skills that you develop will be very useful in other courses that follow your introduction to chemistry.

OBJECTIVES

You will be able to:

1. List the common forms of energy.
2. List the basic metric units and the common metric prefixes.
3. Convert a metric measurement made in one unit to another unit.
4. Convert a measurement made in American units to metric units or metric units to American units.
5. Determine the correct number of significant digits in a calculation involving multiplication or division or both.
6. Convert a volume measurement from liters to milliliters or vice versa.
7. Calculate the density of a substance.
8. Use the density of a substance as a unit factor.
9. List the common temperature scales.
10. Convert a Celsius temperature measurement to Fahrenheit or vice versa.
11. Convert a Celsius temperature measurement to Kelvin or vice versa.

Terms to Know

Chemistry (1-1)	Significant digits (1-11)
Matter (1-2)	Liter (1-14)
Energy (1-4)	Density (1-15)
Gram (1-7)	Temperature (1-17)
Meter (1-7)	

CONTENTS

Note to Students	XXI
1 CHEMICAL TERMS AND MEASUREMENTS	1
1-1 Chemistry	2
1-2 Matter and Mass	3
1-3 Forces	4
1-4 Energy	5
1-5 Some Common Forms of Energy	6
1-6 Units of Measure	7
1-7 The Metric System	8
1-8 Metric Prefixes	9
1-9 Conversion Factors	10
1-10 Metric Unit Conversion	12
1-11 Significant Digits	13
1-12 Significant Digits in Computations	16
1-13 American to Metric Conversions	18
1-14 Volume Measurements	21
1-15 Density	23
1-16 Density as a Unit Factor	25
1-17 Temperature and Heat	27
1-18 Temperature Conversions	29
2 THE CHEMICAL ELEMENTS	38
2-1 States of Matter	40
2-2 Mixtures, Solutions, and Pure Chemicals	40
2-3 Elements and Compounds	41
2-4 Separation, Analysis, and Synthesis	43
2-5 The Elements	44
2-6 Chemical Elements on Earth	45
2-7 Chemical Observations	49
2-8 Theories and Models	50
2-9 Atomic Theory	52
2-10 Using the Atomic Theory	53
2-11 Subatomic Particles	54
2-12 The Nuclear Atom	57

2-13 Atomic Structure	60
2-14 Isotopes	61
2-15 Atomic Masses	63
2-16 Atomic Weights	64
2-17 Some Facts about Atoms	65
2-18 Special Topic: A Glimpse at Some Elements	66
3 COMPOUNDS AND FORMULAS	72
3-1 Chemical Formulas	74
3-2 The Mole	75
3-3 Molar Mass	77
3-4 Avogadro's Number	77
3-5 The Molar Mass as a Unit Factor	78
3-6 Number of Atoms in a Sample	80
3-7 Empirical Formulas	82
3-8 Empirical Formula Calculations	83
3-9 Formula Units and Moles of Compounds	87
3-10 Actual Formulas	89
3-11 Moles of Compounds	91
3-12 Mass and Mole Relations from Formulas	92
3-13 Percentage-by-Mass Composition	96
3-14 The Uses of Formulas	99
3-15 Chemical Reactions	100
3-16 Chemical Equations	101
3-17 Balanced Equations	102
4 ATOMIC STRUCTURE AND THE PERIODIC TABLE	110
4-1 Composition of Atoms	112
4-2 Cathode-Ray Tubes	112
4-3 Gas Discharge Tubes	114
4-4 The Bohr Model	115
4-5 Quantum Jumps	116
4-6 The Quantum Mechanical Model	117
4-7 Electrons in Atoms	119
4-8 Energy States	120
4-9 Electronic Configuration	122
4-10 Energy Level Structure	122
4-11 Relative Energies of the Sublevels	124
4-12 The Electronic Configuration of the Elements	125
4-13 The Periodic Table	127
4-14 The Periodic Table and Electronic Configurations	128
4-15 Parts of the Periodic Table	131
4-16 Classes of Elements	132

4-17 Groups of Elements	134
4-18 Reading the Periodic Table	134
4-19 Shorthand Electronic Configurations	135
4-20 Ionization Energy	136
4-21 Atomic Sizes	138
4-22 Special Topic: Light from Atoms	140

5 CHEMICAL BONDS 146

5-1 The Nature of Chemical Bonding	148
5-2 Electron Dot Symbols	149
5-3 Chemical Bonds	151
5-4 Ion Formation	152
5-5 Formulas for Ions	153
5-6 The Ionic Bond	153
5-7 Formulas of Binary Ionic Compounds	155
5-8 The Covalent Bond	156
5-9 Molecules and Ions Compared	157
5-10 Bonding Abilities of Nonmetals	159
5-11 The Diatomic Molecular Elements	160
5-12 Electron Dot Structures of Molecules	161
5-13 Multiple Bonds	163
5-14 Writing Electron Dot Structures	164
5-15 Polyatomic Ions	166
5-16 Electron Dot Structures of Polyatomic Ions	169
5-17 Shapes of Molecules	171
5-18 Using the VSEPR Theory	174
5-19 Electronegativity	176
5-20 Polar Bonds	178
5-21 Polar Molecules	179

6 CHEMICAL NOMENCLATURE 186

6-1 Chemical Names	188
6-2 Classifying Compounds	189
6-3 Naming Ions	190
6-4 Formulas from Ions	192
6-5 Naming Ionic Compounds	193
6-6 Naming Nonmetal–Nonmetal Binary Compounds	194
6-7 Naming Binary Acids	196
6-8 Naming Oxyacids	196
6-9 Names of Oxyanions	197
6-10 Names from Formulas	198
6-11 Formulas from Names	200
6-12 Reading Labels	202

7	CHEMICAL REACTIONS AND EQUATIONS	206
7-1	The Physical and Chemical Forms of the Elements	208
7-2	Chemical Reactions and Equations	209
7-3	Conservation of Mass in Chemical Reactions	210
7-4	Coefficients in Equations	211
7-5	Balancing Chemical Equations	212
7-6	Writing Equations	215
7-7	Equations with Added Information	217
7-8	Chemical Reactions	218
7-9	Exothermic and Endothermic Reactions	221
7-10	Chemical Energy	222
7-11	Rates of Reactions	224
	Special Topic: Energy and Society	230
7-12	Energy Sources and Uses in the United States	230
7-13	Alternative Energy Sources	231
7-14	Solar Energy	233
8	CHEMICAL STOICHIOMETRY	238
8-1	The Mole Revisited	240
8-2	Chemical Stoichiometry	241
8-3	Molar Interpretation of an Equation	242
8-4	Molar Ratios	243
8-5	Molar Ratios as Unit Factors	244
8-6	Mass-to-Mole Calculations	247
8-7	Mass-to-Mass Calculations	250
8-8	Limiting Reactant	255
8-9	The Calorie and the Joule	257
8-10	Heat of Reaction	258
8-11	Measuring Heats of Reaction	260
8-12	Stoichiometry and Energy Changes	261
8-13	Special Topic: Food Energy and Calories	263
9	GASES: THE GAS LAWS	272
9-1	Properties of Gases	274
9-2	Pressure	275
9-3	Measurement of Gas Pressures	275
9-4	Units for Pressure	276
9-5	Boyle's Law or Volume-Pressure Law	277
9-6	Charles' Law or Volume-Temperature Law	278
9-7	Pressure-Temperature Law	279
9-8	Boyle's Law Calculations	280