Reviews

General Chemistry, Second Edition

Jean B. Umland and Jon M. Bellama. West Publishing: St. Paul, MN, 1996. xxviii + 1098 pp. Figs., tables, and photos. 22.3 × 26.1 cm.

This general chemistry textbook is a revision of the first, 1993, edition. It is intended for a one-year comprehensive first course in general chemistry. Although stated that no prior chemistry is assumed, the text proceeds rapidly into various chemical topics. Chapter 1 is a broad introduction briefly covering naming, simple equation balancing, the periodic table, ions and ionic compounds, and prediction of reaction products. Chapters 2, 3, and 4 cover basic material on measurement, stoichiometry, and reactions in solution. Gases and an introduction to thermodynamics follow. Chapters 7 through 10 cover atomic structure, the periodic table, bonding, and molecular geometry. A discussion of oxidation–reduction follows, chapter 11. Liquids, solids, changes of state, and a more detailed chapter on chemical solutions come next. Two chapters on chemical equilibrium and a more complete discussion of thermodynamic principles appear along with a chapter on acid–base chemistry, chapters 14 through 17. Chapter 18 discusses chemical kinetics; chapter 19 electrochemistry; and chapter 20, nuclear chemistry. Chapters 21 (nonmetals) and 24 (transition metals and complexation) contain the descriptive chemistry of the more common elements. Chapter 22 is an introduction to organic molecules and chapter 23 is a rather extensive discussion of polymers, both synthetic and natural. An appendix contains a mathematical primer, steps for balancing oxidation–reduction equations, the usual thermodynamic and solubility product data, and a listing (1993) the top 50 chemicals employed by industry.

There are extensive introductions for students and instructors at the beginning of the textbook stating the rationale used in preparing the text and providing suggestions for alterations in the order of presentation should a different sequence of topics be desired. The instructors' edition contains extra marginal notes throughout the chapters, with helpful suggestions and references for supplemental background material. Numerous references are made for the instructors to an available CD-ROM supplement. The authors' comments and presentation reflect a thorough understanding of the needs and abilities of students. The text material is clearly written with detailed explanations and interesting, current examples familiar to students. There are numerous sample problems and practice problems interspersed within the body of the text. End-of-chapter exercises are extensive and subdivided into sections of additional practice problems, problems which tie together various topics within a chapter, applications-type exercises drawing upon common everyday life, and a self-test section. In total there is an average of 115 end-of-chapter exercises for each chapter plus the self-test questions. Approximately 15% of the exercises are new, not in the first edition. The text makes extensive use of color both in its molecular diagrams and in color-coding problems for which answers are available. A one to two page summary at the end of each chapter contains new terms in bold type and their definitions. When new terms appear in the body of a chapter their definitions are incorporated into the paragraph in italic type for emphasis. A unique feature continued from the first edition is at the end of each chapter a personal reflection by an individual scientist, teacher, student, or person in a related field discussing how chemistry impacted upon him or her and the importance of chemistry as a part of their vocation. There are some omissions of material found in most current textbooks. Graham's law of diffusion is not discussed nor is the concept of overall reaction rate order. References are cited for the instructor, justifying these omissions.

This textbook is student-friendly. Although perhaps not as rigorous as some competing texts, it is worthy of consideration for a one-year general chemistry course. The usual supplements are also available to support the text material.

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Essential Chemistry

Raymond Chang. McGraw-Hill: New York, 1996. xxvii + 719 pp. Figs., tables, and photos. 21.1 × 26.2 cm.

Essential Chemistry offers material that would be appropriate as an introduction to chemistry. I would recommend it for students in education and majors in biology, chemistry, and physics, and other programs requiring only one year of chemistry. The text uses ample color, illustrations, and many photographs to highlight the easy-to-read pages. Italics and boldfacing are used to define terms, which are also collected in a glossary at the end of the text. Figure and photograph captions are prominently located in the margins. There are no other margin notes. Example problems are easily distinguished by their yellow highlighting. All practice exercise problems are answered at the end of a chapter. There is a good distribution of end-of-chapter questions and problems. These are divided in the same order as the chapter sections. Answers to the even-numbered problems are provided. Each chapter opens with the same schlieric pattern and a "short historical vignette or contemporary story that is relevant to the subject of the chapter." Chapters are subdivided and a summary and key words list are provided.

Chapter coverage is traditional. Atomic and molecular structure, nomenclature, periodic table, bonding, and the states of matter are presented in the first twelve chapters. Chapters 13 and 14 introduce organic and polymer chemistry. Equilibria (acid–base, solubility, and complex ion) and kinetics are covered in four chapters. The chapter on thermodynamics precedes a chapter on oxida-

tion–reduction reactions and electrochemistry. Coordination compounds and nuclear chemistry finish out the topics. There are no separate chapters on descriptive chemistry or biochemistry; rather the author has integrated these subjects into several of the chapters and problems. A problem-solving approach is used throughout the textbook. The writing style makes the reading pleasant.

Few concepts are not covered in this volume. There is no presentation on molecular orbital theory. Only first-order kinetics are introduced. Graham's law of diffusion/effusion is not presented. Semiconductors have not been discussed either. Hydronium ion concentration is introduced in the chapter on acid–base chemistry, but the simple hydrogen ion is used in problem solving. Standard U. S. notation for group numbering has been used. The metalloids include polonium and astatine.

Appendix 4 shows a table of the elements (through lawrencium) and the derivation of their names and symbols as presented by G. P. Dinga, *Chemistry*, **1968**, *41*(2), 20-22. Atomic masses (to four significant figures) in this table and throughout the textbook are based on 1961 values. Thus germanium is listed as mass 72.59 instead of 72.61, and the radioactive elements' most stable/common isotope masses are not in agreement with the latest standard values.

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Chemistry: The Study of Matter and Its Changes, Second Edition

James E. Brady and John R. Holum. Wiley: New York, 1966; xxxi + 1056 pp. Figs., tables, and photos. 21.2 × 26.2 cm.

Although this is only the second edition, this book has its roots in the textbooks by Brady and by Brady and Gerald Humiston that first appeared over twenty years ago. It remains largely in the tradition of the major textbooks of that era in its order and style of presentation. Organic compounds are treated very briefly in two places before the main organic chapter near the end of the book, which emphasizes IUPAC nomenclature rules. Descriptive inorganic chemistry is dispersed through the book but a three-chapter supplement on descriptive chemistry of the elements is available. There are no separate chapters on materials or the environment. The appearance is clean and easy to read, with few extraneous figures and boxes. There are some places, however, where an additional figure would help the reader, such as at the first discussion of calorimetry. In the initial chapters there is some emphasis in the example problems on checking answers for reasonableness; but this is almost completely abandoned in the later chapters—even in examples, such as the Clausius–Clapeyron equation, where it is important. The solution of stoichiometry problems emphasizes the factor-label method; oddly, this material precedes the section on balancing chemical equations. This book does rather less than many others in relating chemistry to the "real world". The standard industrial polymers are mentioned but the student is not told about the recycling codes on the bottoms of plastic containers that identify the material.

This edition retains many of the positive features of its predecessors. It is, on the whole, clear, well-balanced, and free of excessive historical and technical detail. It has changed less than most other general chemistry textbooks and remains a good choice for those who want a traditional treatment of general chemistry.

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Basic Chemistry, Seventh Edition and Alternate {Shorter} Edition

G. William Daub and William S. Seese. Prentice Hall: Upper Saddle River, NJ, 1996; xvii + 652 pp. Figs. and tables. 21.2 × 26.2 cm.

This textbook has not been reviewed in this *Journal* since its third edition in 1982. As a result it is not possible to detail all of the changes that may have occurred since then and persisted into this latest edition. Nevertheless, it is clear from inspection that the basic structure of the seventh edition, including the ordering of chapters, is essentially the same as it was in the third edition. The main difference is that the current edition has just nineteen chapters in all, one fewer (despite the brief contents listing only the first seventeen of them) than the third edition. Apparently the two chapters on organic chemistry have been incorporated into one.

Despite the reduction in the number of chapters the current cloth edition has 656 pages—a paperback alternate edition contains the first seventeen chapters, 496 pages—compared to 596 pages in the earlier reviewed edition. The increase in the number of pages is no doubt largely accounted for by the new features announced by the publisher. These include (i) a countdown section as a bridge at the beginning of each chapter except the first; (ii) study exercises, problems with answers strategically inserted into the text; (iii) marginal "you and chemistry" icons highlighting real-world material in adjacent text; (iv) end of chapter essays on elements and compounds; (v) content changes on calculating oxidation numbers in chapters 6 and 16, on molecular shapes (VSEPR) in chapter 6, on dilution of molar solutions in chapter 14 (conversion of solution concentration deleted), on colloids and suspensions in chapter 15; (vi) revised essays on chemistry of the atmosphere; (vii) addition of over 100 new problems; (viii) marginal study hints and end-of-chapter summaries and quizzes. Students and/or instructors will find some if not all of the pedagogical

devices incorporated in items i-iv and vi-viii above useful in learning and teaching chemistry, respectively. It is difficult to judge the effectiveness of any one of them without actually having used the text. However, I will express some opinions below. The changes in contents listed in item v presumably have been made based on experience and therefore should be improvements. In any case, none of the changes is so major that the book loses its basic character.

My favorites among the pedagogical devices noted above are the end-of-chapter essays on elements and compounds and the revised essays on chemistry of the atmosphere. In these the author becomes more expansive and his writing style more attractive. Not that there are no difficulties or flaws in these essays. There are. But in a sense that is part of their attraction and even strength. For example, I was a bit disappointed that little effort was made in the essays on gold, silver, and copper to compare these elements—these chemical siblings—with one another, prospectively in the case of gold and silver, and retrospectively in the case of silver and copper. But really, it is at least in part the job of the instructor to use these essays to help students make connections that will enrich their understanding and appreciation of chemistry. In this light, the fact that the essays are there is much more important than perceived flaws.

Nevertheless, I cannot contain my unhappiness at the way carbon dioxide is mistreated in a number of the essays. The essay on carbon dioxide at the end of chapter 9 is seriously deficient in that it never mentions explicitly the fact that carbon dioxide is essential to most, if not all, life on earth and that it is the only source of oxygen in our atmosphere through its metabolism by plants, algae, and certain bacteria. Instead, we are warned that "Humans cannot breathe air containing more that 5 to 10% CO_2 without losing consciousness, and prolonged exposure can result in death." I think the author has things terribly muddled here. The effect on humans more likely is due to oxygen deficiency rather than on CO_2 accumulation per se. In addition we are referred to another essay on pollutants in the atmosphere in which CO_2 is identified as one. Finally, in an essay at the end of chapter 11 on the greenhouse effect and global warming, CO_2 is identified as an atmospheric greenhouse gas along with three others (the most important greenhouse gas, water vapor, is never mentioned) completing an undeserved negative picture of CO_2 as a trace pollutant, greenhouse gas, dangerous to humans in high concentration. Considering the fact that CO_2 plays essential roles in sustaining life, including its role in stimulating autonomic breathing in humans and no doubt in other mammals, this negative image is really undeserved. Despite these deficiencies even these essays pertaining to CO_2 can be used by the instructor positively to point out, as I would, what a good guy CO_2 really is despite its bad press. The presence of the essays is again at least as important as their content.

The new feature that I found least attractive was item iii, the marginal icons, which seemed to me of dubious pedagogical value. Their placements depend on judgment—based on what criteria I am not sure—of the relevance of adjacent text to a prospective unknown reader. Their presence has the effect of someone other than the reader highlighting certain text passages. However, with fewer than one hundred icons in over six hundred pages they are not at all overused.

The seventh edition of this textbook contains a number of new features that enhance its pedagogic utility while the basic character and structure exhibited in earlier editions are maintained. Potential users who liked an earlier edition will probably like the seventh edition even better. For prospective new users it is worth looking at seriously.

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Introduction to College Chemistry, First Edition

Jerry A. Driscoll. Kendall/Hunt: Dubuque, IA, 1994; 358 pp. Figs. and tables. 23.7 × 27.5 cm.

This book is directed toward an audience of non-science majors. Its choice of topics places it squarely in the camp of those who favor a simplified version of the science-majors general chemistry course for this audience. Topics treated in the fifteen chapters include measurement and the metric system, physical and chemical properties of matter, elements, compounds, and equations. The periodic table is then introduced followed by chapters on atomic structure and chemical bonding. Nomenclature forms the subject of an entire chapter. Chemical calculations are treated rather late in chapters 10 and 12, while the optional chapter 11 covers inorganic descriptive chemistry. Chapters on the gas laws, liquids and solids, and solutions round out the book. This is a manageable amount of material for a one-semester course. No chapters on organic chemistry or biochemistry are included. Each chapter is preceded by a set of learning goals and followed by problems which are (except in the measurement, stoichiometry, and gas law chapters) largely qualitative. Answers to selected exercises are provided in an appendix.

The author does a good job of reminding students of the experimental nature of chemistry by describing and interpreting experiments (which are generally simple enough to be demonstrated live to the class) that bear on the concepts being developed. The writing style is clear and concise, and remarkably few typos were noted. Many worked-out examples are provided.

This is a first edition, and, as such, suffers from some first-edition glitches that could have used the help of a reliable editor. Among them is the habit of mentioning concepts before they are discussed in the text. As one example of this, the formulas of ionic compounds are discussed in chapter 4, but students learn only in chapter 7 what ions are. Lewis symbols for N and O are presented showing unpaired electrons, but Hund's rule is not dis-

cussed until the following page. Sometimes, rather challenging concepts are simply "sneaked" in without any discussion, for example sign conventions for heat (p 48), mechanical energy units (p 52) and the relation between color of light and energy (p 99). Too much reliance is placed on the stability of the noble gas configuration without a careful explanation of *why* it is so stable. For example, it is stated that "the explanation [for the higher ionization of He than H] is that helium has a pair of electrons in the 1*s* subshell, which gives it greater stability, and it is therefore more difficult to remove the outermost electron".

The book is produced by photo offset so that the production quality is not comparable to more expensive works. The computer-drawn figures are not of particularly high quality, although they are clear and generally accurate. Instructors searching for a reasonably priced, clearly written text would do well to examine this one.

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Models of Matter: Principles and Perspectives of Chemistry

Gayl H. Wiegand. West: St. Paul, MN, 1995; xvii + 584 pp. Figs. and tables. 21.2 × 25.4 cm.

This is a text for a one-semester chemistry course for non-science majors and assumes little or no prior familiarity with chemistry. The author begins with a philosophical discussion of the practice of science. Scientific "facts", laws, theories, and hypotheses are defined, along with several examples. This chapter will provide material for lively class discussion, as some of the liberal arts students taking this course may well be interested in the philosophical underpinnings of science.

The second chapter begins with a discussion of the nature of reality: absolute reality vs. the Copenhagen interpretation, in which the act of observation affects the outcome of the measurement. This nicely lays the groundwork for an intelligent discussion of the uncertainty principle in a later chapter. From here on, through chapter 6, the text covers material which would be appropriate for a "prep. chem." course, and at nearly the

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same level. Measurements and units, the factor-label method, and exponential notation are covered in chapter 2. Chapter 3 gives a definition of chemistry, introduces the concepts of matter and energy, states of matter, pure substances and mixtures, and elements and compounds. Chapter 4 covers Dalton's atomic theory, the laws of definite and multiple proportions; surveys the periodic table; and introduces chemical formulas and equations and balancing them. Chapter 5 treats atomic structure; it describes the experiments that led to the discovery of subatomic particles and introduces the Bohr model and wave mechanics. The analogy of the shapes of orbitals and their nodes to the modes of vibration of a stretched string is pointed out. There is an intriguing discussion of the limits to scientific knowledge, in terms of the uncertainty principle and wave–particle duality.

Chapter 6 discusses bonding: the octet rule, the charges of ions of representative elements, and drawing Lewis dot structures are covered. There is even some discussion of VSEPR and molecular polarity. The chapter on solutions treats intermolecular forces and rationalizes the "like dissolves like" rule. The author introduces the mole and molarity in this chapter as well, even though there is no discussion of stoichiometry (other than definite proportions) elsewhere in the text.

Remaining chapters cover acids, bases, and chemical equilibrium, redox, energy and nonrenewable natural resources, organic chemistry, polymers, and environmental issues. These chapters emphasize basic concepts and definitions, such as LeChatelier's principle, and present representative reactions. Very few calculations are done, which is appropriate for this audience. The author introduces entropy and the second law in the chapter on energy. He even briefly mentions free energy, but there is not enough detail to make this concept very meaningful. I suppose I would rather have seen some illustrations of the amounts of energy available from various fuels and foods, even if some simple calculations and bond energies needed to be introduced. The discussions of nonrenewable energy resources and our profligate consumption of them, as well as the treatment of environmental issues in connection with CFC's, greenhouse gases, chemical waste disposal, and nuclear power plants are all quite well done and rather sobering.

In summary, this is a well-written, literate and up-to-date text, which not only treats a large number of "skills" which might be needed by a student who decides to continue in chemistry, but also presents a reasonable description of the nature of scientific knowledge and how science is actually done. The discussions of the societal issues of energy resources and the protection of the environment are intelligent and compelling.

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Fundamentals of Chemistry, Second Edition

Ralph A. Burns, with contributions by John W. Hill. Prentice-Hall: Englewood Cliffs, NJ, 1995; xx + 743 pp. Figs., tables, and photos. 21.1 × 26.2 cm.

Essentials of Chemistry, Second Edition

Ralph A. Burns, with contributions by John W. Hill. Prentice-Hall: Englewood Cliffs, NJ, 1995; xviii + 608 pp. Figs., tables, and photos. 20.1 × 25.3 cm. PB.

The two texts reviewed are identical except that the *Essentials* text has a soft cover while the *Fundamentals* text has a hard cover and three additional chapters at the end, covering nuclear, organic, and biochemistry. The texts are nicely laid out and beautifully illustrated with full-color illustrations and photographs like most modern general chemistry texts and are written in a clear, nonintimidating style. Science-phobic students will probably appreciate comments like: "Just for kicks, lets try another conversion factor . . . *the answer is* Absurd! How can a bed be 860 in^2/ft long"?

Thus, on the surface, these texts appear to be attractive candidates for the less intimidating reduced-length texts sought by many instructors today. However, I am not sure if there is an appropriate audience for these texts.

The reduction in length compared to today's mainstream college texts has been achieved in two ways. First, it completely leaves out the three traditional chapters on descriptive main group and transition metal chemistry and chapters on free energy and electrochemistry; and kinetics and equilibrium are combined into a single chapter. The result is that there is virtually no discussion of the fascinating variety of chemical reactions and chemical properties that originally turned most professional chemists on to chemistry, and there is no discussion of the principles of thermodynamics, which attempt to explain why chemical reactions proceed. The word "entropy" does not appear in either text. I often judge the level of mathematics required for a general chemistry text from the equilibrium chapter. Are equilibrium problems solved using the quadratic equation, by successive approximation, or by computer, or are second order equations avoided altogether? In this text, discussion of the "equilibrium constant expression" takes up only two pages, including one trivial example, and so my test fails for lack of data. With the exception of one page, the acid–base chapter treats only integer pH values; thus, facility with high school algebra is not required for this text.

The second way that the reduction in length has been achieved is by shortening the discussion of every remaining topic to the bare essentials. For example, coverage of the colligative properties of solutions (freezing point depression, boiling point elevation, colloids, and osmotic pressure) is present, but takes up only four pages. I am afraid the result will be that students of this text may do well on standardized tests because of the comprehensive coverage of elementary topics, but they will carry nothing of value away from the course because they have studied nothing in depth.

College students with no prior knowledge of chemistry may find this text a useful preparation for a standard college level general chemistry course, but they would not be prepared for second-year chemistry courses at my university after completing only this text. Students using this text as their only exposure to chemistry would also be poorly served because it focuses on the mechanics of elementary chemistry—moles, limiting reagents, balancing equations, etc.—while neglecting the big picture issues (like what forces drive chemical reactions) that such students might carry over to their eventual major field of study.

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