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Book Review of Quantum Chemistry, 2nd Edition

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Book Review of Quantum Chemistry, 2nd Edition

Abstract
This article presents a review of the second edition of Quantum Chemistry by D.A. McQuarrie.

Disciplines
Curriculum and Instruction | Educational Assessment, Evaluation, and Research | Other Chemistry | Science and Mathematics Education

Comments
Marc Loudon’s *Organic Chemistry* has a reputation as one of the most widely used textbooks for the first year of college-level organic chemistry. Loudon’s classic textbook, now in its fifth edition with a new publisher, brings some improvements over past editions.

Loudon states in the preface of this edition (p XXXI) “an overarching goal of my text is to help students achieve relational understanding of organic chemistry” (emphasis in the original). As chemical educators know, complete understanding of organic reaction mechanisms is difficult for many students. The author uses acid—base chemistry in a new approach to provide enhanced insight into reaction mechanisms and problem solving. Chapter 3 contains a nice elucidation of acid—base chemistry and the basic organic chemistry reaction mechanism. This concept is a common theme as the book unfolds.

One great improvement over previous editions is the color enhancement throughout the textbook. For example, many reaction mechanisms are driven home by the use of colored arrows: a red arrow for the base nucleophile and a blue arrow for the leaving group. This use of color-coded arrows in the reaction mechanisms is new to this edition. Not limited to arrows in reaction mechanisms, the color enhancement is also used to add clarity to molecular models, energy diagrams, and to discussions of stereo- and regiochemistry. Another improvement included in this edition is what the author calls tiered topic development, which provides reinforcement of important ideas. For example, Chapter 4 covers the structure and reactivity of alkenes; Chapters 6 and 7 follow up by addressing the application and stereochemistry of alkenes. There are also many examples of how organic chemistry affects our everyday lives. Students could benefit from photographs that accompany many of these real-life applications.

The book has 1672 problem-solving activities, many of which are new to this edition and come directly from relevant literature. The textbook does not include solutions to problems, so the student needs to purchase the Study Guide and Solutions Manual for solutions to selected problems. This reviewer did not have access to the Study Guide and Solutions Manual, instructor’s material, or any online applications that accompany this textbook.

In summary, the renowned reputation of the previous editions of Loudon’s *Organic Chemistry* is clearly preserved in this newest edition of the book. If you enjoyed using the fourth edition in your organic chemistry lecture course, then I can recommend this new edition without reservation as a viable replacement for your future use.

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**Arrow Pushing in Organic Chemistry: An Easy Approach to Understanding Reaction Mechanisms**

by Daniel E. Levy


reviewed by Bridget G. Trogden

“When stuck, draw a dipole!” For teachers who find themselves uttering variations on this statement while teaching organic chemistry, *Arrow Pushing in Organic Chemistry* by Daniel E. Levy will be an important supplement to their course. The text is laid out to introduce fundamental concepts such that the student can learn to rationalize the nature of reactants rather than memorize a list of seemingly unconnected reactions.

The desire to alleviate the memorization game in organic chemistry is a major premise of Levy’s book. A few schemes are presented early in Chapter 1 to demonstrate that simply looking at a reaction does not give the reader any insight into the underlying principles at play. The book instead unifies a diverse array of topics by focusing on a central strategy: First, teach the student to identify acids and bases; from there, other concepts fall into place. Electron pairs are described as sources of electron density that drive reactions to occur; just as electricity in a home involves energy flow from regions of higher potential to lower potential, so do molecules need differences in electron density in order to react.

The global view of organic chemistry continues throughout the text. One would expect to see mechanisms presented early in a book that has “arrow pushing” in the title, and this text does not disappoint. Levy describes that bonds are broken and formed through three main types of mechanisms: hemolytic, heterolytic,
and concerted (pericyclic-type) reactions. Students are given problems that introduce electron pushing before any reaction types are even presented, laying the foundation for other concepts. When introducing the all-important concept of the nucleophile, Levy shows the student how to look to multiple competing factors such as basicity, polarizability, steric, solvent, and electronegativity rather than memorizing a list of hard-and-fast trends that do not hold true in every situation. The reader is always encouraged to think globally and apply a handful of concepts to many different situations.

Much of the success of these strategies relies on the understanding that organic chemistry is traditionally a third-semester chemistry course. Levy’s book thus builds upon a general standing that organic chemistry is traditionally a third-semester course. Levy shows the student how to look to multiple competing factors such as basicity, polarizability, steric, solvent, and electronegativity rather than memorizing a list of hard-and-fast trends that do not hold true in every situation. The reader is always encouraged to think globally and apply a handful of concepts to many different situations.

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a course using this text needed all of these sections, but it is helpful that the topics are available.

As in the first edition, the second edition emphasizes readability. Even within extensive mathematical treatments, McQuarrie does a good job of establishing a narrative flow in the explanations. The first edition was printed entirely in black ink. The second edition has added a brown color to stylistic elements and line graphs. In some places, the added color clarifies the graphical presentation, but in other cases, it seems to add relatively little pedagogical value. An odd aspect of the book’s layout is its use of low-resolution screen capture of data. Given the tremendous effort expended in setting the book’s mathematical equations, it is anachronistic that so little effort is made to bring these figures to the same level of quality.

My misgivings about some of these details aside, the revisions of McQuarrie’s Quantum Chemistry are useful. The first edition was always an excellent choice for an introductory course in quantum mechanics; the second edition will not cede that designation. Both editions successfully strike a balance between too much and too little mathematics. Instructors can make pedagogical decisions on where to embellish derivations, knowing that the text offers students a good framework for this material. As a generalized treatment of quantum chemistry, the second edition keeps McQuarrie’s text a contender in the textbook market.

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