时代教育·国外高校优秀教材精选

有机化学基础

Fundamentals of Organic Chemistry

（英文版·原书第4版）

（美）约翰·麦克默里（John McMurry）著

机械工业出版社
CHINA MACHINE PRESS

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John McMurry: Fundamentals of Organic Chemistry, 4th Edition

(ISBN 0-534-35215-4)

图书在版编目（CIP）数据

有机化学基础：第4版/（美）麦克默里（Mcmurry，J.）著. —北京：机械工业出版社，2002. 10

（时代教育·国外高校优秀教材精选）

ISBN 7-111-11068-4

Ⅰ. 有… Ⅱ. 麦… Ⅲ. 有机化学—高等学校—教材—英文 Ⅳ. 062

中国版本图书馆CIP数据核字（2002）第081435号

机械工业出版社（北京市百万庄大街22号 邮政编码100037）

责任编辑：刘小慧 郑 玫 封面设计：鞠 杨

责任印制：付方敏

北京铭成印刷有限公司印刷·新华书店北京发行所发行

2003年1月第1版第1次印刷

787mm×1092mm 1/16·40印张·2插页·784千字

定价：40.00元

凡购本书，如有缺页、倒页、脱页，由本社发行部调换

本社购书热线电话（010）68993821、88379646

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出版说明

随着我国加入WTO，国际间的竞争越来越激烈，而国际间的竞争实际上也就是人才的竞争、教育的竞争。为了加快培养具有国际竞争力的高水平技术人才，加快我国教育改革的步伐，国家教育部近来出台了一系列倡导高校开展双语教学、引进原版教材的政策。以此为契机，机械工业出版社拟于近期推出一系列国外影印版教材，其内容涉及高等学校公共基础课，以及机、电、信息领域的专业基础课和专业课。

引进国外优秀原版教材，在有条件的学校推动开展英语授课或双语教学，自然也引进了先进的教学思想和教学方法，这对提高我国自编教材的水平，加强学生的英语实际应用能力，使我国的高等教育尽快与国际接轨，必将起到积极的推动作用。

为了做好教材的引进工作，机械工业出版社特别成立了由著名专家组成的国外高校优秀教材审定委员会。这些专家对实施双语教学做了深入细致的调查研究，对引进原版教材提出许多建设性意见，并慎重地对每一本将要引进的原版教材一审再审，精选再精选，确认教材本身的质量水平，以及权威性和先进性，以期所引进的原版教材能适应我国学生的外语水平和学习特点。在引进工作中，审定委员会还结合我国高校教学课程体系的设置和要求，对原版教材的教学思想和方法的先进性、科学性严格把关，同时尽量考虑原版教材的系统性和经济性。

这套教材出版后，我们将根据各高校的双语教学计划，举办原版教材的教师培训，及时地将其推荐给各高校选用。希望高校师生在使用教材后及时反馈意见和建议，使我们更好地为教学改革服务。

机械工业出版社

2002年3月

序

本书作者是美国著名的Cornell大学的教授，所写基础有机化学和高等有机化学教材均有很高水平，内容十分丰富，国内外采用者甚多。这本教材是他专门撰写的一本简明教材。按照他在序言中的说法，写此书是因为喜爱，他喜欢把一个复杂的课题试着从另外的角度，用更加简单的方式来描述。我认为他达到了这个目的。

本书所用体系为传统的功能团体系，有关生物分子和生物化学过程的内容占有较大篇幅。另外，书中简要地介绍了有机分子结构测定中应用最多的红外光谱、紫外光谱和核磁共振谱方法，由于作者选择了一些比较典型的例子，对于初学者来说已够用。

本书具体内容包括结构和键、酸和碱，有机化合物的特性一烷烃，烯烃一有机化学反应的本质，烯烃和炔烃，芳香化合物，立体化学，卤代烷，醇、醚和酚，醛和酮一亲核加成反应，羧酸和衍生物，羰基α取代反应和缩合反应，胺，化学结构的测定，原生质一碳水化合物，生物分子一氨基酸、肽和蛋白质，生物分子一类脂和核酸，新陈代谢途径的有机化学。

本书在每章之后，除附有用以扩展视野的阅读材料和习题外，还附有关键词和反应小结，在一般教科书中很少见到。且该书版面明快，文字简洁流畅，使人有一种爱不释手的感觉。可作为生物、制药、农业等各专业的教学参考书或教材，也可供专业技术人员参考。

宋心琦
清华大学化学系
2002年8月

Preface

I wrote this book for a very simple reason: I love writing. I get great satisfaction from taking a complicated subject, turning it around until I see it from a new angle, and then explaining it in simple words. I write to explain chemistry to students today the way I wish it had been explained to me years ago.

The enthusiastic response of both students and faculty to the three previous editions has been very gratifying and suggests that this book has served students well. I hope you will find that this fourth edition of *Fundamentals of Organic Chemistry* builds on the strengths of the first three and serves students even better. I have made every effort to make this fourth edition as effective, clear, and readable as possible; to show the beauty and logic of organic chemistry; and to make the subject enjoyable to learn.

Organization and Teaching Strategies

The primary organization of this book is by functional group, beginning with the simple (alkanes) and progressing to the more complex. Within this primary organization, however, there is also an emphasis on explaining the fundamental mechanistic similarities of reactions. This emphasis is particularly evident in the chapters on carbonyl-group chemistry (Chapters 9–11), where mechanistically related reactions like the aldol and Claisen condensations are covered together. Memorization is minimized and understanding maximized with this approach.

Reaction Mechanisms

In the first edition, I introduced an innovative vertical format for explaining reaction mechanisms that met with an enthusiastic response. Now set off by color panels, mechanisms shown in this format have the reaction steps printed vertically while the changes taking place in each step are explained next to the reaction arrow. This format allows the reader to see what is occurring at each step in a reaction without having to jump back and forth between structures and text. Pages 115 and 240 show examples.

Basic Learning Aids

Clarity of explanation and smoothness of information flow are crucial requirements for any textbook. In writing and revising this text, I consistently

aim for summary sentences at the beginning of paragraphs, lucid explanations, and smooth transitions between paragraphs and between topics. New concepts are introduced only when they are needed—not before—and are immediately illustrated with concrete examples. Frequent cross-references to earlier material are given, and numerous summaries are provided to draw information together, both within chapters and at the ends of chapters. In addition, the back of this book contains a wealth of material helpful for learning organic chemistry, including a large glossary, an explanation of how to name polyfunctional organic compounds, and answers to most in-text problems. For still further aid, an accompanying *Study Guide and Solutions Manual* gives summaries of reaction mechanisms and of methods for preparing functional groups, a list of named reactions with examples, and a list of the uses of important reagents.

Features of the Fourth Edition

The primary reason for preparing a new edition is to keep the book up-to-date, both in its scientific coverage and in its pedagogy. My overall aim has been to retain and refine the features that made earlier editions so successful, while adding new ones.

- **Full color** has now been added throughout the text, both for its visual appeal and for its pedagogical value in highlighting the reacting parts of molecules.
- **The writing** has again been revised at the sentence level, paying particular attention to such traditionally difficult subjects as stereochemistry and nucleophilic substitution reactions.
- **The artwork** has been redone, and many new computer-generated models have been added. Figures frequently present structures in several different formats, side by side, so that students learn structures thoroughly and become used to the various ways chemists graphically represent their work. Look at pages 14 and 63 to see some examples.
- **Stereo views** of computer-generated ball-and-stick molecular models have been added as an aid for three-dimensional perception. A stereo viewer is bound into the back of the book. Even the problems make use of stereo views. Some examples appear on pages 184 and 230.
- **The organic chemistry of metabolic pathways** is presented in Chapter 17. Several of the most important pathways—glycolysis and the citric acid cycle, for example—are dissected and analyzed according to the organic reaction mechanisms by which the various steps occur. This chapter will be of particular interest to the large number of students in health sciences who traditionally take this organic chemistry course.
- **Interlude boxes** at the end of each chapter present interesting applications of organic chemistry relevant to the main chapter subject. Including several topics from science, medicine, and day-to-day life, these

applications enliven and reinforce the material presented in each chapter. Some Interlude topics address environmental concerns and examine popular assumptions about chlorinated organic compounds or chemical toxins in our food and water. Other Interludes discuss such topics as antibiotics and antiinflammatory agents.

- **Biologically important organic reaction mechanisms** are specially identified by the use of a margin icon. Students often wonder about what topics are "important," and this icon helps students in the biological sciences answer that question. See pages 293 and 366, for example.
- **Spectra** are all new. They have been redrawn for clarity and accuracy. Some examples appear on pages 420 and 427.
- **New problems** have been added at the end of each chapter. Some are a new kind of problem called **Visualizing Chemistry,** in which students are challenged to make the connection between typical line-bond drawings and computer-generated molecular models. See pages 35 and 215, for example.

To facilitate the changes outlined above, some material from the previous edition has been compressed, several reactions (such as ozonolysis) that have little relevance to biological chemistry have been deleted, and other material has been rearranged.

Acknowledgments

I sincerely thank the many people whose help and suggestions were so valuable in preparing this fourth edition, particularly Phyllis Niklas, Jamie Sue Brooks, Beth Wilbur, and Harvey Pantzis. It is a real pleasure to work with such consummate professionals.

Among the reviewers providing valuable comments were Jean C. Beckman, University of Evansville; Claudia P. Cartaya, Appalachian State University—Rainking Science Center; Mildred V. Hall, Pennsylvania State University—Dubois Campus; Miroslav Krumpolc, University of Illinois; Keith F. McDaniel, Ohio University; John A. Miller, Western Washington University; David Minter, Texas Christian University; Roger K. Murray, University of Delaware; George V. Odell, Oklahoma State University; James Piper, Simmons College; Stanley Raucher, University of Washington; Gary Richmond, Grand Valley State University; David J. Rislove, Winona State University; Kevin Smith, University of California—Davis; Ronald Starkey, University of Wisconsin; Kathleen M. Trahanovsky, Iowa State University; and Carl C. Wamser, Portland State University.

A Complete Ancillary Package

For Instructors

Test Items
by Tammy Tiner, Texas A & M University
- Contains over 500 short-answer and multiple-choice test items.
- Computerized versions are also available.

Transparencies
- A complete new set of approximately 112 full-color transparencies covering most topics in the course.

Computerized Test Items
- Contains over 500 short-answer and multiple-choice test items.
- Available for DOS/Windows and Macintosh platforms.
- Print version also available.

For Students

Study Guide and Solutions Manual
by Susan McMurry
- Includes solutions to all end-of-chapter problems, detailed explanations of how answers are obtained, and skills to master for each chapter.
- Also contains a summary of general reaction mechanisms, a summary of methods for preparing functional groups, and a summary of the uses of important reagents.

Organic Chemistry Toolbox
by Norbert J. Pienta, University of North Carolina, Chapel Hill
- A text-specific program for constructing molecular models, drawing Lewis dot structures, creating animations of reactions, solving chemistry problems, and studying structures.
- Available on hybrid CD-ROM.

Beaker 2.1
- Software that is an expert system for the organic chemistry student. Available for DOS/Windows and Macintosh platforms.
- Sophisticated, yet easy to use program for exploring organic chemistry principles; for studying and solving, sketching, and analyzing molecular structures; for constructing NMR spectra; and for performing reactions.

A Note for Students

We have similar goals. Yours is to learn organic chemistry; mine is to do everything possible to help you learn. It's going to require work on your part, but the following suggestions should prove helpful:

Don't read the text immediately. As you begin each new chapter, look it over first. Read the introductory paragraphs, find out what topics will be covered, and then turn to the end of the chapter and read the summary. You'll be in a much better position to understand new material if you first have a general idea of where you're heading. Once you've begun a chapter, read it several times. First read the chapter rapidly, making checks or comments in the margin next to important or difficult points; then return for an in-depth study.

Keep up with the material. Who's likely to do a better job—the runner who trains five miles per day for weeks before a race, or the one who suddenly trains twenty miles the day before the race? Organic chemistry is a subject that builds on previous knowledge. You have to keep up with the material on a daily basis.

Work the problems. There are no shortcuts here. Working problems is the only way to learn organic chemistry. The practice problems show you how to approach the material, the in-text problems provide immediate practice, and the end-of-chapter problems provide additional drill and some real challenges. Answers and explanations for all problems are given in the accompanying *Study Guide and Solutions Manual.*

Ask questions. Faculty members and teaching assistants are there to help you. Most of them will turn out to be extremely helpful and genuinely interested in seeing you learn.

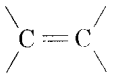
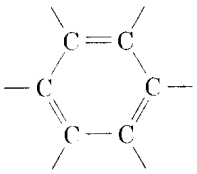
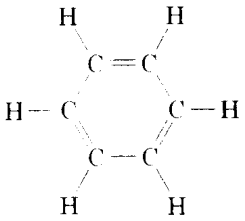
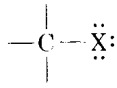
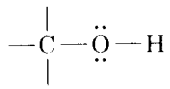
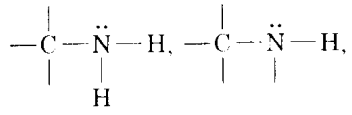
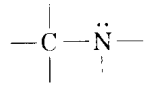
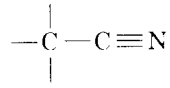
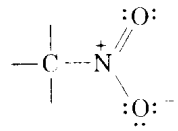
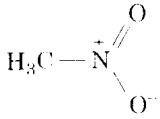
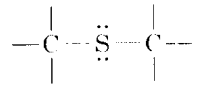
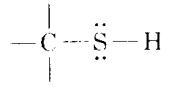
Use molecular models. Organic chemistry is a three-dimensional science. Although this book uses many careful drawings and stereo views to help you visualize molecules, there's no substitute for building a molecular model, turning it in your hands, and looking at it from different views.

Use the study guide. The *Study Guide and Solutions Manual* that accompanies this text gives complete solutions to all problems and provides

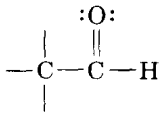
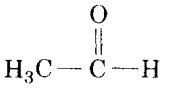
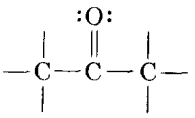
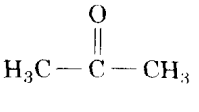
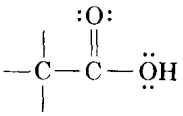
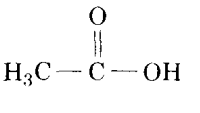
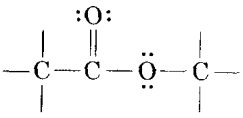
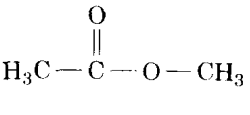
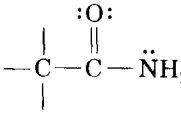
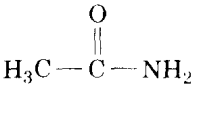
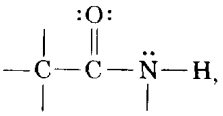
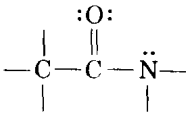
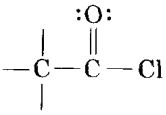
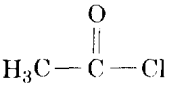
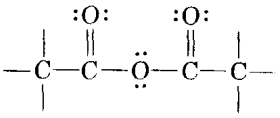
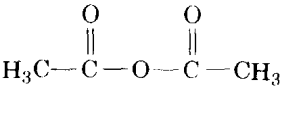
a wealth of supplementary material. Included are a list of study goals for each chapter, outlines of each chapter, a summary of name reactions, a summary of methods for preparing functional groups, a summary of the uses of important reagents, and tables of spectroscopic information. Find out ahead of time what's there so that you'll know where to go when you need help.

Good luck. I sincerely hope you enjoy learning organic chemistry and that you come to see the logic and beauty of its structure. I would be glad to receive comments and suggestions from any who have learned from this book.

Some Functional Groups

Family name	*Functional group structure*[a]	*Simple example*	*Name ending*
Alkane	(Contains only C—H and C—C single bonds)	CH_3CH_3	*-ane* Ethane
Alkene		$H_2C=CH_2$	*-ene* Ethene (Ethylene)
Alkyne	$-C\equiv C-$	$H-C\equiv C-H$	*-yne* Ethyne (Acetylene)
Arene			None Benzene
Halide	 (X = F, Cl, Br, I)	H_3C-Cl	None Chloromethane
Alcohol		H_3C-O-H	*-ol* Methanol
Ether		$H_3C-O-CH_3$	*ether* Dimethyl ether
Amine	 	H_3C-NH_2	*-amine* Methylamine
Nitrile		$H_3C-C\equiv N$	*-nitrile* Ethanenitrile (Acetonitrile)
Nitro			None Nitromethane
Sulfide		$H_3C-S-CH_3$	*sulfide* Dimethyl sulfide
Thiol		H_3C-SH	*-thiol* Methanethiol

[a]The bonds whose connections aren't specified are assumed to be attached to carbon or hydrogen atoms in the rest of the molecule.

Family name	*Functional group structure*[a]	*Simple example*	*Name ending*
Carbonyl, 			
Aldehyde			*-al* Ethanal (Acetaldehyde)
Ketone			*-one* Propanone (Acetone)
Carboxylic acid			*-oic acid* Ethanoic acid (Acetic acid)
Ester			*-oate* Methyl ethanoate (Methyl acetate)
Amide			*-amide* Ethanamide (Acetamide)
			
			
Carboxylic acid chloride			*-oyl chloride* Ethanoyl chloride (Acetyl chloride)
Carboxylic acid anhydride			*-oic anhydride* Ethanoic anhydride (Acetyl anhydride)

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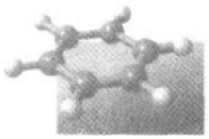

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