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ORGANIC CHEMISTRY

A SHORT
COURSE

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Organic Chemistry ***A Short Course***

NINTH EDITION

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Organic Chemistry
A Short Course

Preface

Purpose Several decades have passed since the first edition of this text was published. Although the content continues to change, our purpose in writing it remains much the same—to present as clearly as possible a brief introduction to modern organic chemistry.

This book was written for students who, for the most part, will not major in chemistry, but whose main interest—agriculture, biology, human or veterinary medicine, pharmacy, nursing, medical technology, health sciences, engineering, home economics, forestry, or whatever—requires some knowledge of organic chemistry. To maintain the interest of these students, we have made a special effort to illustrate the practical applications of organic chemistry to everyday life and to biological processes. The success of this approach is demonstrated by the widespread use of this text by hundreds of thousands of students here in the U.S. and worldwide, via numerous translations.

The text is designed for a one-semester introductory course, but it is easily adapted to other formats. It is often used in either a one- or two-quarter course. In some countries (France and Japan, for example) it is an introductory text for chemistry majors, followed by a longer and more detailed full-year text. And in a number of high schools, it is used as the text for a second-year course, following the usual introductory general chemistry.

Organization The organization is fairly classical, with some exceptions. After an introductory chapter on bonding, isomerism, and an overview of the subject (Chapter 1), the next three chapters treat in sequence saturated, unsaturated, and aromatic hydrocarbons. The concept of reaction mechanism is presented early, and examples are included in virtually all subsequent chapters. Stereoisomerism is also introduced early, briefly in Chapters 2 and 3, and then given separate attention in a full chapter (Chapter 5). Halogen compounds are used in Chapter 6 as a vehicle for introducing aliphatic substitution and elimination mechanisms and dynamic stereochemistry.

Chapters 7 through 10 take up oxygen functionality in order of increasing oxidation state of carbon (alcohols and phenols, ethers, aldehydes and ketones, acids and their derivatives). Brief mention of sulfur analogs is made in these chapters. Chapter 11 deals with amines.

Chapters 2 through 11 treat all of the main functional groups and constitute the heart of the course. Chapter 12 then takes up spectroscopy, with an emphasis on NMR and applications to structure determination. It handles the student's question—how do you know that those molecules really have the structures you say they have?

Next come two chapters on topics not always treated in introductory texts but especially important in practical organic chemistry—Chapter 13 on heterocyclic compounds and Chapter 14 on polymers. The book ends with four chapters on biologically important substances—lipids, carbohydrates, amino acids and proteins, and nucleic acids.

***“A Word About”
Essays***

Although relevant applications of organic chemistry are stressed throughout the text, short sections under the general rubric *A Word About* emphasize applications to other branches of science and to human life. These sections, which have been a popular feature, appear at appropriate places within the text rather than as isolated essays. Numbered and printed in special type, they stand out from the text so that instructors can easily require these sections or not, as desired. There are thirty-five of these essays, three new in this edition.

***Examples and
Problems***

Problem solving is essential to learning organic chemistry. **Examples** (worked-out problems) appear at appropriate places within each chapter to help students develop these skills. These examples and their solutions are clearly marked. Unsolved **problems** that provide immediate learning reinforcement are included within each chapter and are supplemented with an abundance of end-of-chapter problems. The combined number of examples and problems is 925, or an average of more than 51 per chapter.

***New in the Ninth
Edition***

The entire text was carefully revised to sharpen the writing and clarify difficult sections. In addition to many small changes, users of the previous edition will notice the following more substantial changes: (1) The footnote on arrow formalism in Chapter 1 has been upgraded to a section. (2) In response to reviewers' interest, two sections introducing the thermodynamics and kinetics of organic reactions have been added to Chapter 3. Reaction energy diagrams are introduced here and are used again in Chapter 6. (3) In Chapter 5 and throughout subsequent chapters, the terms “chiral center” and “asymmetric carbon atom” have been replaced with the currently accepted “stereogenic center” and “stereogenic carbon atom.” (4) A *Reaction Summary* section, located before the end-of-chapter problems, is included in each chapter where new reactions are introduced. After each reaction type, a reference to the appropriate section of the text is provided. This summary collects new reactions in one easy-to-find location and will help students organize their study of new materials effectively.

Three new *A Word About* sections have been added in this edition, and three former sections of this type have been deleted. We hope that students and teachers alike will enjoy the following timely topics: C₆₀, an Aromatic Sphere: The Fullerenes; Degradable Polymers; and Bacterial Cell Walls, Enzyme Inhibitors, and Antibiotics. Please write to us with your comments.

We are very conscious of the need to keep the book to a manageable size for the one-semester course. Wherever possible, some old material has been deleted to make room for the new material that has been added. Users will find that this edition is nearly identical in length to the previous one.

Ancillaries Two accompanying books are available to help the student in this course learn organic chemistry.

The **Study Guide and Solutions Book** contains answers to all text problems, a guide on how to reason out the answers, a summary of each chapter, a summary of the new reactions in each chapter, a list of learning objectives for each chapter, a summary of important reaction mechanisms, and sample test questions.

The **Laboratory Manual** contains experiments that have been time-tested with thousands of students. A substantial number of the preparative experiments contain procedures on both the **macro-** and the **microscale**, thus adding considerable flexibility for the instructor and the opportunity for both types of laboratory experience for the student. We have been careful to avoid hazardous chemicals on the OSHA list and to minimize contact with solvents, and so forth. The student and instructor are clearly warned whenever caution or special care is required, and thorough waste disposal instructions are consistently specified. The manual has tear-out, perforated report sheets convenient for student and instructor. It is also a convenient size for the nonmajor lab. Most experiments can be completed in the relatively short two- or three-hour lab period for nonmajors. The manual contains appendices giving atomic weights, other properties of common reagents, instructions for the teacher on how to make or obtain special reagents, and a list of chemicals and equipment required for each experiment that will simplify ordering and stocking the labs. Experiments are a good mix of techniques, preparations, tests, and applications.

An **Instructor's Resource Manual** and a set of transparencies and black line transparency masters are also available.

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One pleasure of authorship is receiving letters from students who have benefited from the book, and from their teachers. We thank here all who have written to us, from all parts of the world, since the last edition; we have incorporated many of their suggestions in this revision. We will be happy to hear from users and nonusers, faculty and students, with suggestions for further improvements.

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Contents

Preface xvii

Introduction

To the Student 1

What Is Organic Chemistry About?	1
Synthetic Organic Compounds	1
Why Synthesis?	2
Organic Chemistry in Everyday Life	3
Organization	4
A Word About	4
The Importance of Problem Solving	5

1 Bonding and Isomerism 6

1.1	How Electrons Are Arranged in Atoms	6
1.2	Ionic and Covalent Bonding	8
1.2a	Ionic Compounds	9
1.2b	The Covalent Bond	11
1.3	Carbon and the Covalent Bond	12
1.4	Carbon–Carbon Single Bonds	13
1.5	Polar Covalent Bonds	14
1.6	Multiple Covalent Bonds	16
1.7	Valence	18
1.8	Isomerism	19
1.9	Writing Structural Formulas	20
1.10	Abbreviated Structural Formulas	22
1.11	Formal Charge	24
1.12	Resonance	25
1.13	Arrow Formalism	27
1.14	The Orbital View of Bonding; the Sigma Bond	29
1.15	Carbon sp^3 Hybrid Orbitals	30
1.16	Tetrahedral Carbon; the Bonding in Methane	32
1.17	Classification According to Molecular Framework	34
1.17a	Acyclic Compounds	34
1.17b	Carbocyclic Compounds	34
1.17c	Heterocyclic Compounds	34
1.18	Classification According to Functional Group	35
	Additional Problems	38

2 Alkanes and Cycloalkanes; Conformational and Geometric Isomerism 42

- 2.1 Introduction 42
- 2.2 The Structures of Alkanes 42
- 2.3 Nomenclature of Organic Compounds 44
- 2.4 The IUPAC Rules for Naming Alkanes 45
- 2.5 Alkyl and Halogen Substituents 47
- 2.6 Use of the IUPAC Rules 49

A WORD ABOUT

- 1. Isomers, Possible and Impossible 50
- 2.7 Sources of Alkanes 51
- 2.8 Physical Properties of Alkanes 52
- 2.9 Conformations of Alkanes 52
- 2.10 Cycloalkane Nomenclature and Conformation 55
- 2.11 *Cis-trans* Isomerism in Cycloalkanes 59
- 2.12 Summary of Isomerism 60
- 2.13 Reactions of Alkanes 61
 - 2.13a Oxidation and Combustion; Alkanes as Fuels 61
 - 2.13b Halogenation of Alkanes 62
- 2.14 The Free Radical Chain Mechanism of Halogenation 64

A WORD ABOUT

- 2. Methane, Marsh Gas, and Miller's Experiment 66

- Reaction Summary 67
- Additional Problems 67

3 Alkenes and Alkynes 70

- 3.1 Definition, Classification, and Physical Properties 70
- 3.2 Nomenclature 71
- 3.3 Some Facts About Double Bonds 75
- 3.4 The Orbital Model of a Double Bond; the Pi Bond 76
- 3.5 *Cis-trans* Isomerism in Alkenes 79

A WORD ABOUT

- 3. The Chemistry of Vision 80
- 3.6 Addition and Substitution Reactions Compared 81
- 3.7 Polar Addition Reactions 81
 - 3.7a Addition of Halogens 81
 - 3.7b Addition of Water (Hydration) 82
 - 3.7c Addition of Acids 82

3.8	Addition of Unsymmetric Reagents to Unsymmetric Alkenes; Markovnikov's Rule	83
3.9	Mechanism of Electrophilic Addition to Alkenes	86
3.10	Markovnikov's Rule Explained	88
3.11	Reaction Equilibrium: What Makes a Reaction Go?	89
3.12	Reaction Rates: How Fast Does a Reaction Go?	91
3.13	Hydroboration of Alkenes	94
3.14	Addition of Hydrogen	95
3.15	Electrophilic Additions to Conjugated Systems	96
3.16	Free-Radical Additions; Polyethylene	98
3.17	Oxidation of Alkenes	99
3.17a	Oxidation with Permanganate; a Chemical Test	99
3.17b	Ozonolysis of Alkenes	100
3.17c	Other Alkene Oxidations	101

A WORD ABOUT

4. Ethylene and Acetylene 102

3.18	Some Facts About Triple Bonds	103
3.19	The Orbital Model of a Triple Bond	103
3.20	Addition Reactions of Alkynes	105
3.21	Acidity of Alkynes	106

A WORD ABOUT

5. Petroleum, Gasoline, and Octane Number 107

Reaction Summary	109
Additional Problems	110

4 Aromatic Compounds 114

4.1	Historical Introduction	114
4.2	Some Facts About Benzene	115
4.3	The Kekulé Structure of Benzene	116
4.4	The Resonance Model for Benzene	117
4.5	Orbital Model for Benzene	118
4.6	Symbols for Benzene	119
4.7	Nomenclature of Aromatic Compounds	119
4.8	The Resonance Energy of Benzene	122
4.9	Electrophilic Substitution	124
4.10	The Mechanism of Electrophilic Aromatic Substitution	125
4.10a	Halogenation	126
4.10b	Nitration	127
4.10c	Sulfonation	127
4.10d	Alkylation and Acylation	128

4.11	Ring-Activating and Ring-Deactivating Substituents	129
4.12	<i>Ortho</i> , <i>Para</i> -Directing and <i>Meta</i> -Directing Groups	129
4.12a	<i>Ortho</i> , <i>Para</i> -Directing Groups	130
4.12b	<i>Meta</i> -Directing Groups	133
4.12c	Substituent Effects on Reactivity	134
4.13	The Importance of Directing Effects in Synthesis	134
4.14	Polycyclic Aromatic Hydrocarbons	135

A WORD ABOUT

6.	Polycyclic Aromatic Hydrocarbons and Cancer	137
----	---	-----

A WORD ABOUT

7.	C ₆₀ , an Aromatic Sphere: The Fullerenes	138
----	--	-----

Reaction Summary	141
------------------	-----

Additional Problems	142
---------------------	-----

5 Stereoisomerism 145

5.1	Introduction	145
5.2	Chirality and Enantiomers	145
5.3	Stereogenic Centers; the Stereogenic Carbon Atom	146
5.4	Configuration and the <i>R-S</i> Convention	152
5.5	The <i>E-Z</i> Convention for <i>Cis-trans</i> Isomers	157
5.6	Polarized Light and Optical Activity	158

A WORD ABOUT

8.	Pasteur's Experiments and the van't Hoff-LeBel Explanation	161
----	--	-----

5.7	Properties of Enantiomers	162
5.8	Fischer Projection Formulas	164
5.9	Compounds with More Than One Stereogenic Center; Diastereomers	167
5.10	<i>Meso</i> Compounds; the Stereoisomers of Tartaric Acid	170
5.11	Stereochemistry; a Recap of Definitions	171
5.12	Stereochemistry and Chemical Reactions	173
5.13	Resolution of a Racemic Mixture	175

Additional Problems	175
---------------------	-----

6 Organic Halogen Compounds; Substitution and Elimination Reactions 180

6.1	Introduction	180
6.2	Nucleophilic Substitution	180
6.3	Examples of Nucleophilic Substitutions	181
6.4	Nucleophilic Substitution Mechanisms	185
6.5	The S _N 2 Mechanism	185
6.6	The S _N 1 Mechanism	188

6.7	The S _N 1 and S _N 2 Mechanisms Compared	191
6.8	Dehydrohalogenation, an Elimination Reaction; the E2 and E1 Mechanisms	194
6.9	Substitution and Elimination in Competition	195
6.9a	Tertiary Halides	195
6.9b	Primary Halides	196
6.9c	Secondary Halides	197

A WORD ABOUT

9.	S _N 2 Reactions in the Cell: Biochemical Methylations	199
----	--	-----

6.10	Polyhalogenated Aliphatic Compounds	200
------	-------------------------------------	-----

A WORD ABOUT

10.	CFCs, the Ozone Layer, and Tradeoffs	202
-----	--------------------------------------	-----

A WORD ABOUT

11.	Insecticides and Herbicides	203
-----	-----------------------------	-----

	Reaction Summary	205
--	------------------	-----

	Additional Problems	205
--	---------------------	-----

7 Alcohols, Phenols, and Thiols 208

7.1	Introduction	208
7.2	Nomenclature of Alcohols	208
7.3	Classification of Alcohols	209
7.4	Nomenclature of Phenols	210
7.5	Hydrogen Bonding in Alcohols and Phenols	210
7.6	Acidity and Basicity Reviewed	212
7.7	The Acidity of Alcohols and Phenols	214
7.8	The Basicity of Alcohols and Phenols	217
7.9	Dehydration of Alcohols to Alkenes	217
7.10	The Reaction of Alcohols with Hydrogen Halides	219
7.11	Other Ways to Prepare Alkyl Halides from Alcohols	221
7.12	A Comparison of Alcohols and Phenols	221
7.13	Oxidation of Alcohols to Aldehydes, Ketones, and Carboxylic Acids	222
7.14	Alcohols with More Than One Hydroxyl Group	224

A WORD ABOUT

12.	Industrial Alcohols	225
-----	---------------------	-----

7.15	Aromatic Substitution in Phenols	226
------	----------------------------------	-----

7.16	Oxidation of Phenols	227
------	----------------------	-----

A WORD ABOUT

13.	Biologically Important Alcohols and Phenols	228
-----	---	-----

7.17	Thiols, the Sulfur Analogs of Alcohols and Phenols	229
------	--	-----

A WORD ABOUT**14. Hair, Curly or Straight 231**

Reaction Summary	230
Additional Problems	233

8 Ethers and Epoxides 236

8.1 Introduction	236
8.2 Nomenclature of Ethers	236
8.3 Physical Properties of Ethers	237
8.4 Ethers as Solvents	238
8.5 The Grignard Reagent; an Organometallic Compound	238
8.6 Preparation of Ethers	241

A WORD ABOUT**15. Ether and Anesthesia 243**

8.7 Cleavage of Ethers	244
8.8 Epoxides (Oxiranes)	245

A WORD ABOUT**16. The Gypsy Moth's Epoxide 246**

8.9 Reactions of Epoxides	247
---------------------------	-----

A WORD ABOUT**17. Epoxy Resins 248**

8.10 Cyclic Ethers	249
Reaction Summary	251
Additional Problems	252

9 Aldehydes and Ketones 255

9.1 Introduction	255
9.2 Nomenclature of Aldehydes and Ketones	256
9.3 Some Common Aldehydes and Ketones	257
9.4 Synthesis of Aldehydes and Ketones	258
9.5 Aldehydes and Ketones in Nature	259
9.6 The Carbonyl Group	260
9.7 Nucleophilic Addition to Carbonyl Groups; an Overview	261
9.8 Addition of Alcohols; Formation of Hemiacetals and Acetals	262
9.9 Addition of Water; Hydration of Aldehydes and Ketones	266
9.10 Addition of Grignard Reagents and Acetylides	267
9.11 Addition of Hydrogen Cyanide; Cyanohydrins	270
9.12 Addition of Nitrogen Nucleophiles	270
9.13 Reduction of Carbonyl Compounds	272
9.14 Oxidation of Carbonyl Compounds	273
9.15 Keto-Enol Tautomerism	274

A WORD ABOUT

18. Tautomerism and Photochromism	276
9.16 Acidity of α -Hydrogens; The Enolate Anion	277
9.17 Deuterium Exchange in Carbonyl Compounds	278
9.18 The Aldol Condensation	279
9.19 The Mixed Aldol Condensation	280
9.20 Commercial Syntheses via the Aldol Condensation	281

A WORD ABOUT

19. Quinones, Dyes, and Electron Transfer	282
Reaction Summary	283
Additional Problems	285

10 Carboxylic Acids and Their Derivatives 289

10.1 Introduction	289
10.2 Nomenclature of Acids	289
10.3 Physical Properties of Acids	293
10.4 Acidity and Acidity Constants	294
10.5 Resonance in the Carboxylate Ion	294
10.6 Effect of Structure on Acidity; the Inductive Effect Revisited	296
10.7 Conversion of Acids to Salts	297
10.8 Preparation of Acids	297
10.8a Oxidation of Primary Alcohols or Aldehydes	298
10.8b Oxidation of Aromatic Side Chains	298
10.8c Reaction of Grignard Reagents with Carbon Dioxide	299
10.8d Hydrolysis of Cyanides (Nitriles)	299
10.9 Carboxylic Acid Derivatives	300
10.10 Esters	301
10.11 Preparation of Esters; Fischer Esterification	302
10.12 The Mechanism of Acid-catalyzed Esterification; Nucleophilic Acyl Substitution	302
10.13 Lactones	304
10.14 Saponification of Esters	305
10.15 Ammonolysis of Esters	306
10.16 Reaction of Esters with Grignard Reagents	306
10.17 Reduction of Esters	307
10.18 The Need for Activated Acyl Compounds	307
10.19 Acyl Halides	308
10.20 Acid Anhydrides	310

A WORD ABOUT

20. Thioesters, Nature's Acyl-Activating Groups	312
10.21 Amides	313

A WORD ABOUT**21. Urea 316**

- 10.22 A Summary of Carboxylic Acid Derivatives 316
- 10.23 The α -Hydrogen of Esters; the Claisen Condensation 318
- Reaction Summary 320
- Additional Problems 322

11 Amines and Related Nitrogen Compounds 326

- 11.1 Introduction 326
- 11.2 Classification and Structure of Amines 326
- 11.3 Nomenclature of Amines 327
- 11.4 Physical Properties of Amines 329
- 11.5 Preparation of Amines; Alkylation of Ammonia and Amines 330
- 11.6 Preparation of Amines; Reduction of Nitrogen Compounds 332
- 11.7 The Basicity of Amines 334
- 11.8 Comparison of the Basicity and Acidity of Amines and Amides 337
- 11.9 Reaction of Amines with Strong Acids; Amine Salts 338
- 11.10 Chiral Amines as Resolving Agents 340
- 11.11 Acylation of Amines with Acid Derivatives 340

A WORD ABOUT**22. Sulfanilamide and Sulfa Drugs 343**

- 11.12 Quaternary Ammonium Compounds 344
- 11.13 Aromatic Diazonium Compounds 344
- 11.14 Diazo Coupling; Azo Dyes 347
- Reaction Summary 349
- Additional Problems 351

12 Spectroscopy and Structure Determination 355

- 12.1 Introduction 355
- 12.2 Principles of Spectroscopy 356
- 12.3 Nuclear Magnetic Resonance Spectroscopy (NMR) 358
 - 12.3a Measuring an NMR Spectrum 358
 - 12.3b Chemical Shifts and Peak Areas 359
 - 12.3c Spin-Spin Splitting 363
- 12.4 ^{13}C NMR Spectroscopy 368

A WORD ABOUT**23. NMR in Biology and Medicine 370**

- 12.5 Infrared Spectroscopy 371
- 12.6 Visible and Ultraviolet Spectroscopy 374

12.7	Mass Spectrometry	377
------	-------------------	-----

	Additional Problems	380
--	---------------------	-----

13 Heterocyclic Compounds 384

13.1	Introduction	384
13.2	Pyridine: Bonding and Basicity	384
13.3	Substitution in Pyridine	386
13.4	Other Six-Membered Heterocycles	389
13.5	Five-Membered Heterocycles: Furan, Pyrrole, and Thiophene	392
13.6	Electrophilic Substitution in Furan, Pyrrole, and Thiophene	394

A WORD ABOUT

24. Porphyrins: What Makes Blood Red and Grass Green? 396

13.7	Other Five-Membered Heterocycles: Azoles	397
13.8	Fused-Ring Five-Membered Heterocycles: Indoles and Purines	398

A WORD ABOUT

25. Morphine and Other Nitrogen-Containing Drugs 400

	Reaction Summary	403
	Additional Problems	404

14 Synthetic Polymers 406

14.1	Introduction	406
14.2	Classification of Polymers	406
14.3	Free-Radical Chain-Growth Polymerization	407
14.4	Cationic Chain-Growth Polymerization	413
14.5	Anionic Chain-Growth Polymerization	414
14.6	Stereoregular Polymers; Ziegler-Natta Polymerization	415
14.7	Diene Polymers: Natural and Synthetic Rubber	417
14.8	Copolymers	419
14.9	Step-Growth Polymerization: Dacron and Nylon	420

A WORD ABOUT

26. Degradable Polymers 422

A WORD ABOUT

27. Aramids, the Latest in Polyamides 424

14.10	Polyurethanes and Other Step-Growth Polymers	425
	Reaction Summary	428
	Additional Problems	429

15 Lipids and Detergents 432

15.1	Introduction	432
15.2	Fats and Oils; Triesters of Glycerol	432