

MODERN METHODS OF ORGANIC SYNTHESIS

The fourth edition of this well-known textbook discusses the key methods used in organic synthesis, showing the value and scope of these methods and how they are used in the synthesis of complex molecules. All the text from the third edition has been revised, to produce a modern account of traditional methods and an up-to-date description of recent advancements in synthetic chemistry. The textbook maintains a traditional and logical approach in detailing carbon–carbon bond formations, followed by a new chapter on the functionalization of alkenes and concluding with oxidation and reduction reactions. Reference style has been improved to include footnotes, allowing easy and rapid access to the primary literature. In addition, a selection of problems has been added at the end of each chapter, with answers at the end of the book. The book will be of significant interest to chemistry and biochemistry students at advanced undergraduate and graduate level, as well as to researchers in academia and industry who wish to familiarize themselves with modern synthetic methods.

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W. Carruthers and Iain Coldham
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Contents

<i>Preface to the first edition</i>	<i>page</i> vii
<i>Preface to the fourth edition</i>	ix
1 Formation of carbon–carbon single bonds	1
1.1 Main-group chemistry	1
1.1.1 Alkylation of enolates and enamines	1
1.1.2 Conjugate addition reactions of enolates and enamines	19
1.1.3 The aldol reaction	27
1.1.4 Asymmetric methodology with enolates and enamines	36
1.1.5 Organolithium reagents	45
1.1.6 Organomagnesium reagents	63
1.1.7 Organozinc reagents	67
1.1.8 Allylic organometallics of boron, silicon and tin	71
1.2 Transition-metal chemistry	75
Problems	101
1.2.1 Organocopper reagents	75
1.2.2 Organochromium chemistry	81
1.2.3 Organocobalt chemistry	85
1.2.4 Organopalladium chemistry	89
2 Formation of carbon–carbon double bonds	105
2.1 β -Elimination reactions	105
2.2 Pyrolytic <i>syn</i> eliminations	111
2.3 Fragmentation reactions	118
2.4 Alkenes from hydrazones	120
2.5 Alkenes from 1,2-diols	123
2.6 Alkenes from alkynes	125
2.7 The Wittig and related reactions	132

vi	<i>Contents</i>	
2.8	Alkenes from sulfones	144
2.9	Alkenes using titanium or chromium reagents	148
2.10	Alkene metathesis reactions	151
	Problems	155
3	Pericyclic reactions	159
3.1	The Diels–Alder cycloaddition reaction	159
3.1.1	The dienophile	162
3.1.2	The diene	174
3.1.3	Regiochemistry of the Diels–Alder reaction	185
3.1.4	Stereochemistry of the Diels–Alder reaction	188
3.1.5	Intramolecular Diels–Alder reactions	193
3.1.6	The retro Diels–Alder reaction	199
3.1.7	Asymmetric Diels–Alder reactions	202
3.2	[2+2] Cycloaddition reactions	211
3.3	Cycloaddition reactions with allyl cations and allyl anions	219
3.4	1,3-Dipolar cycloaddition reactions	222
3.5	The ene reaction	231
3.6	[3,3]-Sigmatropic rearrangements	238
3.6.1	The Cope rearrangement	239
3.6.2	The Claisen rearrangement	244
3.7	[2,3]-Sigmatropic rearrangements	253
3.8	Electrocyclic reactions	259
	Problems	264
4	Radical and carbene chemistry	268
4.1	Radicals	268
4.1.1	Radical abstraction reactions	269
4.1.2	Radical addition reactions	280
4.2	Carbenes	299
	Problems	312
5	Functionalization of alkenes	315
5.1	Hydroboration	315
5.1.1	Reactions of organoboranes	322
5.2	Epoxidation and aziridination	331
5.2.1	Epoxidation	331
5.2.2	Asymmetric epoxidation	337
5.2.3	Aziridination	346

<i>Contents</i>		vii
5.3	Dihydroxylation	349
5.3.1	Dihydroxylation with osmium tetroxide	349
5.3.2	Other methods of dihydroxylation	355
5.3.3	Amino-hydroxylation	358
5.4	Oxidative cleavage	360
5.5	Palladium-catalysed oxidation of alkenes	365
	Problems	367
6	Oxidation	370
6.1	Oxidation of hydrocarbons	370
6.1.1	Alkanes	370
6.1.2	Aromatic hydrocarbons	371
6.1.3	Alkenes	374
6.2	Oxidation of alcohols	378
6.2.1	Chromium reagents	378
6.2.2	Oxidation via alkoxysulfonium salts	381
6.2.3	Manganese reagents	384
6.2.4	Other metal-based oxidants	386
6.2.5	Other non-metal-based oxidants	389
6.2.6	Oxidation to carboxylic acids or esters	392
6.3	Oxidation of ketones	394
6.3.1	α,β -Unsaturated ketones	394
6.3.2	α -Hydroxy-ketones	396
6.3.3	Baeyer–Villiger oxidation of ketones	398
	Problems	402
7	Reduction	405
7.1	Catalytic hydrogenation	405
7.2	Reduction by dissolving metals	422
7.3	Reduction by hydride-transfer reagents	434
7.3.3	Derivatives of lithium aluminium hydride and sodium borohydride	443
7.3.4	Mixed lithium aluminium hydride–aluminium chloride reagents	444
7.3.5	Diisobutylaluminium hydride (DIBAL-H)	445
7.3.6	Sodium cyanoborohydride and sodium triacetoxyborohydride	446
7.3.7	Borane and derivatives	449

viii	<i>Contents</i>	
7.4	Other methods of reduction	454
7.4.1	Enzyme catalysed	454
7.4.2	Wolff–Kishner reduction	457
7.4.3	Reductions with diimide	459
7.4.4	Reductions with trialkylsilanes	460
	Problems	462
	<i>Answers to problems</i>	466
	<i>Index</i>	487

Preface to the first edition

This book is addressed principally to advanced undergraduates and to graduates at the beginning of their research careers, and aims to bring to their notice some of the reactions used in modern organic syntheses. Clearly, the whole field of synthesis could not be covered in a book of this size, even in a cursory manner, and a selection has had to be made. This has been governed largely by consideration of the usefulness of the reactions, their versatility and, in some cases, their selectivity.

A large part of the book is concerned with reactions which lead to the formation of carbon–carbon single and double bonds. Some of the reactions discussed, such as the alkylation of ketones and the Diels–Alder reaction, are well established reactions whose scope and usefulness has increased with advancing knowledge. Others, such as those involving phosphorus ylids, organoboranes and new organometallic reagents derived from copper, nickel, and aluminium, have only recently been introduced and add powerfully to the resources available to the synthetic chemist. Other reactions discussed provide methods for the functionalisation of unactivated methyl and methylene groups through intramolecular attack by free radicals at unactivated carbon–hydrogen bonds. The final chapters of the book are concerned with the modification of functional groups by oxidation and reduction, and emphasise the scope and limitations of modern methods, particularly with regard to their selectivity.

Discussion of the various topics is not exhaustive. My object has been to bring out the salient features of each reaction rather than to provide a comprehensive account. In general, reaction mechanisms are not discussed except in so far as is necessary for an understanding of the course or stereochemistry of a reaction. In line with the general policy in the series references have been kept to a minimum. Relevant reviews are noted but, for the most part, references to the original literature are given only for points of outstanding interest and for very recent work. Particular reference is made here to the excellent book by H. O. House, *Modern Synthetic*

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x

Preface to the first edition

Reactions which has been my guide at several points and on which I have tried to build, I feel all too inadequately.

I am indebted to my friend and colleague, Dr K. Schofield, for much helpful comment and careful advice which has greatly assisted me in writing the book.

26 October 1970

Preface to the fourth edition

Some Modern Methods of Organic Synthesis was originally written by Dr W. (Bill) Carruthers, and three popular editions were published that have helped many students of advanced organic chemistry. Unfortunately, Dr Carruthers died in 1990, just prior to his retirement. As his successor at the University of Exeter, it was appropriate that I should take on the task of preparing the fourth edition of this text. In honour of Dr Carruthers, a similar format to previous editions has been taken, although of course the book has been completely re-written and brought up-to-date (through 2003) to take account of the many advances in the subject since the third edition was published. As in previous editions, the text begins with descriptions of some of the most important methods for the formation of carbon–carbon bonds, including the use of enolates and organometallic compounds for carbon–carbon single-bond formation (Chapter 1), methods for carbon–carbon double-bond formation (Chapter 2), pericyclic reactions (Chapter 3), radicals and carbenes (Chapter 4). There has been some re-organization of material and emphasis has been placed on reactions that are useful, high yielding or selective for organic synthesis. For example, Chapter 1 has been expanded to include some of the most popular and contemporary reactions using main-group and transition-metal chemistry (rather than placing reactions of organoboron and silicon compounds into a separate chapter). A new chapter describing the functionalization of alkenes has been devised, covering reactions such as hydroboration, epoxidation and dihydroxylation (Chapter 5). The book concludes with examples of pertinent oxidation (Chapter 6) and reduction (Chapter 7) reactions that are used widely in organic synthesis. The opportunity has been taken to add some problems at the end of each chapter, with answers at the end of the book. References have been compiled as footnotes on each relevant page for ease of use.

In common with the previous editions, the book is addressed principally to advanced undergraduates and to graduates at the beginning of their research careers. My aim has been to bring out the salient features of the reactions and reagents

rather than to provide a comprehensive account. Reaction mechanisms are not normally discussed, except where necessary for an understanding of the course or stereochemistry of a reaction. My hope is that the book will find widespread use as a helpful learning and reference aid for synthetic chemists, and that it will be a fitting legacy to Dr Carruthers.

The majority of the text was written at the University of Exeter before my move to the University of Sheffield and I would like to acknowledge the encouragement and help of the staff at Exeter.

Part of one chapter was written while I was a Visiting Professor at the University of Miami, and I am grateful to Professor Bob Gawley for hosting my visit. My thanks extend to various people who have proof-read parts of the text, including Chris Moody, Mike Shipman, Mark Wood, Alison Franklin, Joe Harrity, Steve Pih and Ben Dobson. Finally, I would like to thank my family for their patience during the writing of this book.

I. Coldham
January 2004