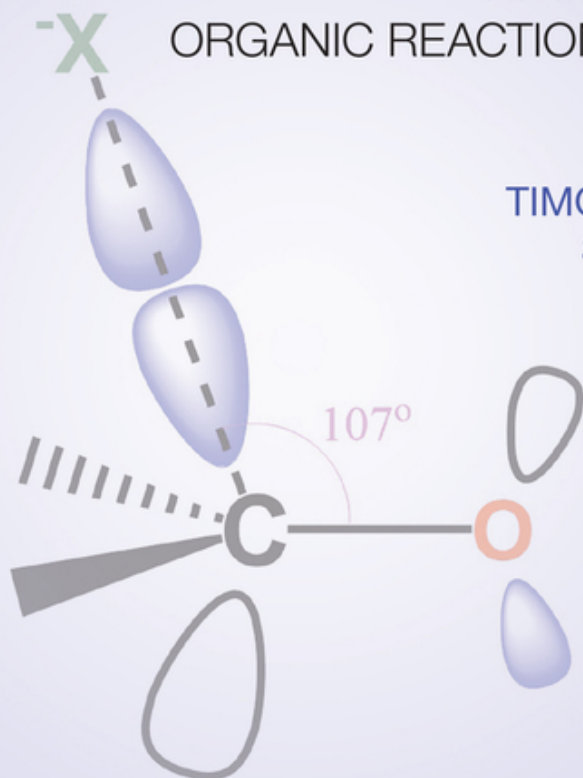


REVISED EDITION

CHEMISTRY OF THE CARBONYL GROUP

A STEP-BY-STEP APPROACH
TO UNDERSTANDING
ORGANIC REACTION MECHANISMS

TIMOTHY K. DICKENS
STUART WARREN



WILEY

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Reaction Mechanisms

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*To Sophie Jackson and
Chris Lester*

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PREFACE

Understanding the movement of electrons as a reaction takes place is perhaps the hardest general concept in Organic Chemistry. This is often referred to as ‘pushing curly arrows’. Once this concept has been grasped, it becomes possible to rationalise what is happening in a chemical reaction and predictions can start to be made. In *Chemistry of the Carbonyl Group*, five chemical reactions are explored. These are nucleophilic addition, nucleophilic substitution, nucleophilic substitution with complete removal of carbonyl oxygen, carbanions and enolisation. With these reactions, it is possible to design and build organic molecules from carbonyl compounds. The last section of the book covers this. This understanding of the processes behind reactions by extrapolation can be used to rationalise organic reactions involving heteroatoms such as nitrogen, phosphorus and sulphur. Other types of chemical reactions, such as electrophilic substitution and addition, become easy to comprehend.

It is the authors' firm belief that the most effective way to learn is by practice and interaction. With this in mind, the reader is asked to predict what would happen under a specific set of reaction conditions. The book is divided into frames. These frames pose a question and invite the reader to predict what will happen. Subsequent frames give the solution but then pose more questions to develop a theme further. Therefore, the book should be worked through with pen and paper.

The reactions of the carbonyl group are some of the first reactions that a student studying Chemistry at university will encounter. As such, this book should be tackled just before, or when, a student is starting Organic Chemistry. Indeed, at Peterhouse, first year Natural Science students taking Chemistry are encouraged to work through this book during the Christmas break. Students who do this make substantially faster progress with the Cambridge Organic Chemistry course during the Lent term. The book could also be used by gifted or curious sixth-form students who are keen to broaden their knowledge of Organic Chemistry beyond the A-level syllabus.

This book was first published in 1974. After some discussion, it was decided not to change the text substantially. The motivation was very much to improve the layout of the book; hence *all* the diagrams have been redrawn using ChemDraw and the text formatted using the text mark-up language L^AT_EX. One area that it might have been appropriate to develop is a discussion of the frontier orbitals; this would lead to an understanding of why the “magic angle” of attack in nucleophilic addition^{1–3} is 107°. However, this could be seen as an unnecessary distraction, depending on what other Chemistry topics the reader is already familiar with.

Timothy K. Dickens, Cambridge February 2018

¹I. Fleming. *Molecular Orbitals and Organic Chemical Reactions – Reference Edition* Wiley, (2010). ISBN: 978-0-470-74658-5, section 5.1.3, page 214.

²J. Clayden, N. Greeves and S. Warren. *Organic Chemistry*. 2nd Ed. OUP, (2012). ISBN: 978-0-19-927029-3, page 130.

³D. Klein. *Organic Chemistry*. 2nd Ed. Wiley, (2015). ISBN: 978-1-118-45228-8, page 937.

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SOME HELP THAT YOU MAY NEED

Throughout this book, several references are made to consulting an advisor. An advisor is someone who can guide the reader if a concept is not fully understood or more detail is required. An advisor could be a college tutor or supervisor, lecturer, graduate student or even a student in a later year who has a passion for chemistry. If the book is being tackled by a sixth former, then perhaps his or her chemistry teacher could act in the role of an advisor.

Books that you might find useful:

General Organic Chemistry Textbooks:

J. Clayden, N. Greeves and S. Warren. *Organic Chemistry*. 2nd Ed. OUP, (2012). ISBN: 978-0-19-927029-3.

D. Klein. *Organic Chemistry*. Wiley, (2015). ISBN: 978-1-118-45228-8.

The solutions to the problems posed in these books can be found in:

J. Clayden and S. Warren. *Solutions Manual to Accompany Organic Chemistry*. OUP, (2013). ISBN: 978-0-19-966334-7.

D. Klein. *Student Study Guide and Solutions Manual for Organic Chemistry*. 2nd Ed. Wiley, (2015). ISBN: 978-1-118-64795-0.

For those who wish to gain a better grasp of using Molecular Orbitals to describe reactions in Organic Chemistry see:

I. Fleming. *Molecular Orbitals and Organic Chemical Reactions – Reference Edition*, Wiley (2010). ISBN: 978-0-470-74658-5.