

# reactions of alkenes

## REACTIVITY OF $C=C$

most common rxns of double bonds transform  $\pi$  bond  $\rightarrow$  sigma bond

$\pi$  bc sigma bonds are more stable

types of rxns:

types of rxns:

addition - 2 molec combine to form 1

product molec; most common

e.g. the rxns in this chapter

elimination - 1 molec splits into 2

fragment molec

substitution - 1 fragment replaces

another fragment in a molec

## ELECTROPHILIC ADDITION TO ALKENES

$e^-$  in  $\pi$  bonds are loosely held (delocalized above & below sigma bond)

double bond acts as Nuc, attacking  $E^+$

$E^+$  has an affinity toward these  $e^-$

most of these rxns have carbocations as intermediates

electrophilic additions -  $E^+$  bonds to one of the double-bonded C's first, followed by the Nuc

regioselectivity & stereochemistry of rxn

when its stereospecific important

## MECHANISM 8-1:

### ELECTROPHILIC ADDITION TO ALKENES

step 1: Attack of  $\pi$  bond on  $E^+$  forms

carbocation



$+$  charge on more substituted C

step 2: Attack by Nuc gives product



## SUBSTITUTED $C=C$

how substituted a C chain is = how many

Cs are attached to  $C=C$

example:



monosubstituted



disubstituted

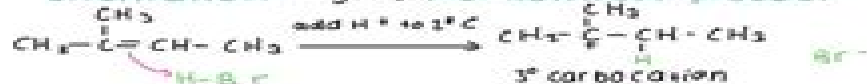
## REGIOSELECTIVITY

$\rightarrow$  regiochemistry - orientation (what part of reagent adds to which end of an unsymmetrical alkene) of addition

$\rightarrow$  Markovnikov's rule - in an electrophilic addition to an alkene, the  $E^+$  adds in such a way to produce the most stable intermediate (e.g. carbocation) (extended rule)

addition of a proton acid to  $C=C$  results in a product w/ proton acid bonded to C atom w/ greater # of H atoms (least sub.)

rxns that follow this rule follow Markovnikov orientation & give Markovnikov product



$\rightarrow$  anti-Markovnikov orientation - follow the opp. of Markovnikov's rule; give the anti-Markovnikov product

## MECHANISM 8-2

### IONIC ADDITION OF $HX$ TO AN ALKENE

step 1: Protonation of  $\pi$  bond forms a carbocation



$+$  on more sub. C

step 2: Attack by halide gives product



### Characteristics

$\rightarrow$  follows Markovnikov's rule

$\rightarrow$  halogen usually goes on most sub. C

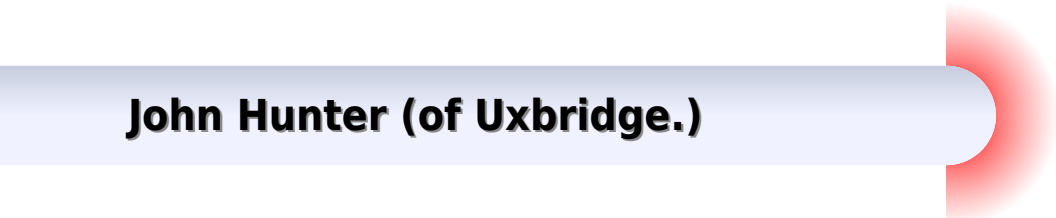
$\rightarrow$  rearrangements may occur

$\rightarrow$  formation of carbocation is rate-determining

$\rightarrow$  stereochemistry - random

# Organic Chemistry Notes For Ss

**John Hunter (of Uxbridge.)**



## **Organic Chemistry Notes For Ss:**

**Progress in Physical Organic Chemistry** Robert W. Taft, 2009-09-17 Progress in Physical Organic Chemistry is dedicated to reviewing the latest investigations into organic chemistry that use quantitative and mathematical methods. These reviews help readers understand the importance of individual discoveries and what they mean to the field as a whole. Moreover, the authors, leading experts in their fields, offer unique and thought-provoking perspectives on the current state of the science and its future directions. With so many new findings published in a broad range of journals, Progress in Physical Organic Chemistry fills the need for a central resource that presents, analyzes, and contextualizes the major advances in the field. The articles published in Progress in Physical Organic Chemistry are not only of interest to scientists working in physical organic chemistry but also to scientists working in the many subdisciplines of chemistry in which physical organic chemistry approaches are now applied, such as biochemistry, pharmaceutical chemistry, and materials and polymer science. Among the topics explored in this series are reaction mechanisms, reactive intermediates, combinatorial strategies, novel structures, spectroscopy, chemistry at interfaces, stereochemistry, conformational analysis, quantum chemical studies, structure reactivity relationships, solvent, isotope, and solid state effects, long-lived charged, sextet or open shell species, magnetic, non-linear optical, and conducting molecules, and molecular recognition.

**New Theoretical Concepts for Understanding Organic Reactions** Juan Bertrán, Imre G. Csizmadia, 2012-12-06 People who attended the NATO Advanced Study Institute ASI entitled NEW THEORETICAL CONCEPTS FOR UNDERSTANDING ORGANIC REACTIONS held at Sant Feliu de Guixols on the Costa Brava of Spain had a unique experience. They have seen the evolution of the field from qualitative arguments through the generation of Potential Energy Surfaces (PES) to the use of PES in molecular dynamics. The excellent lectures that were dedicated to the various aspects of Potential Energy Surfaces clearly revealed a colossal amount of material that represents our current understanding of the overall problem. It is our hope that the present volume will recreate the excitement in the readers that we all experienced during the meeting in Spain. One can say without too much exaggeration that chemistry has become and exercise on potential energy surfaces (PES). Structural position of the energy minima, spectroscopic vicinity around the minima, and reactivity reaction path along the surface properties may be determined from the analysis of PES. New theoretical tools together with recent developments in computer technology and programming have allowed to obtain a better knowledge of these surfaces and to extract further chemical information from them, so new horizons have been added to Theoretical Organic Chemistry.

**Advances in Quantum Chemistry**, 1995-07-19 Advances in Quantum Chemistry publishes surveys of current developments in the rapidly developing field of quantum chemistry, a field that falls between the historically established areas of mathematics, physics, chemistry, and biology. With invited reviews written by leading international researchers, each presenting new results and insights, this quality serial provides a single vehicle for following progress in this interdisciplinary area.

Theoretical and Computational Models for Organic Chemistry

S.J. Formosinho, Imre G. Csizmadia, Lu s G. Arnaut, 2012-12-06 The papers in this volume were presented at the NATO Advanced Study Institute held in Porto Novo Portugal August 26 September 8 1990 The Institute has been able to cover a wide spectrum of the Theoretical and Computational Models for organic molecules and organic reactions ranging from the ab initio to the more empirical approaches in the tradition established in the previous Institutes at S Feliu de Guixols Spain and Altin luk Turkey The continuity with this work was achieved by inviting half of the lecturers present in those meetings But other important subjects were also covered at Porto Novo by new lecturers both from universities and the industry Molecular Mechanics Protein Structure and Unidimensional Models were introduced by the first time The concept of building on the expertise already acquired and available both in terms of methods and contents to develop in new directions was appreciated by participants and lecturers The Institute first considered the fundamentals of molecular orbital computations and ab initio methods and the construction of Potential Energy Surfaces These subjects were further explored in several applications related with optimization of equilibrium geometries and transition structures Practical examples were studied in Tutorial sessions and solved in the computational projects making use of the Gaussian 88 and Gaussian 90 programs Empirical models can be complementary to the quantum mechanical ones in equilibrium geometry optimizations

**Elements of Chemistry: Organic chemistry. Pt. II. has imprint: New York, John Wiley & son, 1873. 3d London ed. with additions** William Allen Miller, 1857

**Notes on Organic Chemistry** Francis Francis, 1935

**Essentials of Organic Chemistry** Paul M. Dewick, 2006-05-26 Essentials of Organic Chemistry is an accessible introduction to the subject for students of Pharmacy Medicinal Chemistry and Biological Chemistry Designed to provide a thorough grounding in fundamental chemical principles the book focuses on key elements of organic chemistry and carefully chosen material is illustrated with the extensive use of pharmaceutical and biochemical examples In order to establish links and similarities the book places prominence on principles and deductive reasoning with cross referencing This informal text also places the main emphasis on understanding and predicting reactivity rather than synthetic methodology as well as utilising a mechanism based layout and featuring annotated schemes to reduce the need for textual explanations tailored specifically to the needs of students of Pharmacy Medical Chemistry and Biological Chemistry numerous pharmaceutical and biochemical examples mechanism based layout focus on principles and deductive reasoning This will be an invaluable reference for students of Pharmacy Medicinal and Biological Chemistry

**Advances in Physical Organic Chemistry**, 1988-03-16 This is a well established series for the publication of authoritative reviews on the methods and results of the application of quantitative physical and mathematical methods to organic chemistry The authors are acknowledged experts in their particular fields and the contributions give the reader an up to date account of different aspects of physical organic chemistry In the pursuit of challenging problems of organic chemistry the series encourages forward looking reviews on a variety of topics not all of which may as yet conform to conventional notions of the scope of the field

The Art of Problem Solving in Organic

Chemistry Miguel E. Alonso-Amelot, 2023-09-13 The Art of Problem Solving in Organic Chemistry The new edition of the classic textbook that has helped thousands of students understand and solve the complex mechanistic problems posed by organic reactions The Art of Problem Solving in Organic Chemistry is a must have workbook for students and professionals alike offering step by step guidance on applying proven strategies and logical techniques to solve complex reaction mechanism problems The book is organized in two sections The Toolbox and the Problem Chest The first part is presented in four chapters covering advanced contemporary issues of molecular structure and orbital configuration stereoelectronic constraints electron shifts redeployment and arrow pushing allowances and pitfalls as well as functional groups roles and key intermediate species all of which dominate the reaction mechanism scenario These concepts are rounded up by a series of time tested problem analysis strategies and thinking routes shown in flowcharts and illustrated by application to specific cases The Problem Chest puts together a set of 50 newly selected fully discussed mechanism problems of increasing difficulty in which all the power of the Toolbox paraphernalia is put to work Now in its third edition The Art of Problem Solving in Organic Chemistry retains the structure of previous editions previously rated among the 30 best organic chemistry books of all time by BookAuthority More than 50 revised organic reaction mechanism problems are complemented by an entirely new set of problems additional concepts and techniques expanded coverage of applications in contemporary organic chemistry embedded cases of the existing reaction pool taken from recent literature and much more Describes the principles methods tools and problem analysis techniques required to solve organic reaction problems Extends the logic and strategy of the mechanistic approach beyond specific reactions and facts Discusses practical methods for improved problem solving for organic reaction mechanisms Explains tested strategies for analyzing the possibilities of reaction mechanisms between reactants and products Contains detailed appendices with definitions and examples of principles reactions mechanisms and reagents The Art of Problem Solving in Organic Chemistry Third Edition is an essential volume for advanced undergraduates graduate students lecturers and professionals looking to improve their performance in finding solutions to organic reaction problems It is an ideal textbook for courses on organic reactions and problem analysis as well as an excellent supplement for courses covering reactive intermediates and mechanisms of molecular transformations **BIOS Instant Notes in**

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**Reading Book** Edmund Fowle, 2023-12-13 Reprint of the original first published in 1875 The publishing house Anatiposi publishes historical books as reprints Due to their age these books may have missing pages or inferior quality Our aim is to preserve these books and make them available to the public so that they do not get lost Orbital Interaction Theory of Organic Chemistry Arvi Rauk, 2004-04-07 A practical introduction to orbital interaction theory and its applications in modern organic chemistry Orbital interaction theory is a conceptual construct that lies at the very heart of modern organic chemistry Comprising a comprehensive set of principles for explaining chemical reactivity orbital interaction theory originates in a rigorous theory of electronic structure that also provides the basis for the powerful computational models and techniques with which chemists seek to describe and exploit the structures and thermodynamic and kinetic stabilities of molecules Orbital Interaction Theory of Organic Chemistry Second Edition introduces students to the fascinating world of organic chemistry at the mechanistic level with a thoroughly self contained well integrated exposition of orbital interaction theory and its applications in modern organic chemistry Professor Rauk reviews the concepts of symmetry and orbital theory and explains reactivity in common functional groups and reactive intermediates in terms of orbital interaction theory Aided by numerous examples and worked problems he guides readers through basic chemistry concepts such as acid and base strength nucleophilicity electrophilicity and thermal stability in terms of orbital interactions and describes various computational models for describing those interactions Updated and expanded this latest edition of Orbital Interaction Theory of Organic Chemistry includes a completely new chapter on organometallics increased coverage of density functional theory many new application examples and worked problems The text is complemented by an interactive computer program that displays orbitals graphically and is available through a link to a Web site Orbital Interaction Theory of Organic Chemistry Second Edition is an excellent text for advanced level undergraduate and graduate students in organic chemistry It is also a valuable working resource for professional chemists seeking guidance on interpreting the quantitative data produced by modern computational chemists **Organic Chemistry** William B. Tucker, 2024-08-08 With a focus on organic chemistry students at all levels problems are incorporated into the body of the text in an effort to engage students more directly in chemistry Arrowless mechanisms seek to help students develop their electron pushing skills and intuition through repeated practice By design this volume is more actively engaging than a traditional textbook In addition the historical development of ideas is presented to help frame and center these concepts for the reader Primary and summative sources are given for all topics covered The sources provide definitive information for the reader and ensure that all information is supported by peer reviewed experimental sources Features The development of key ideas is presented in their historical context All information presented is supported through citations to chemical literature Problems are incorporated into the body of the text including arrowless mechanisms which encourage students to engage more actively and to develop their electron pushing skills and intuition International Union of Pure and Applied Chemistry style and technical guidelines are

followed throughout the text The problems text and presentation are based on years of classroom refinement of teaching pedagogy

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**Graph Theoretical Approaches to Chemical Reactivity** Danail D. Bonchev,O.G. Mekenyan,2012-12-06 The progress in computer technology during the last 10 15 years has enabled the performance of ever more precise quantum mechanical calculations related to structure and interactions of chemical compounds However the qualitative models relating electronic structure to molecular geometry have not progressed at the same pace There is a continuing need in chemistry for simple concepts and qualitatively clear pictures that are also quantitatively comparable to ab initio quantum chemical calculations Topological methods and more specifically graph theory as a fixed point topology provide in principle a chance to fill this gap With its more than 100 years of applications to chemistry graph theory has proven to be of vital importance as the most natural language of chemistry The explosive development of chemical graph theory during the last 20 years has increasingly overlapped with quantum chemistry Besides contributing to the solution of various problems in theoretical chemistry this development indicates that topology is an underlying principle that explains the success of quantum mechanics and goes beyond it thus promising to bear more fruit in the future

**Cornelius Nepos, by C. Bradley** Cornelius Nepos,1879      **Chemistry Reviews** M. E. Vol'pin,1985      **Elements of Chemistry: Organic chemistry** William Allen Miller,1878      *Chemical News and Journal of Industrial Science* ,1883

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