

ORGANIC CHEMISTRY

REACTIONS

FEATURES OF AN ORGANIC REACTION

Mechanism: Describes the overall reaction using a series of simple steps.

Stoichiometry: Calculate reactants and product masses using the balanced equation and molar masses.

Kinetics: The study of the reaction rate and mechanism.

Theoretical yield: Mass of product given by a complete reaction.

Yield: $\frac{\text{actual}}{\text{theoretical}}$ mass (theoretical yield).

Equilibrium: Reaction does not proceed to completion, instead, it reaches a balanced state of forward and reverse reactions.

Major reaction types:

- Acid
- Base
- Oxidation/Reduction
- Condensation
- Substitution (SN1 , SN2)
- Ionic Reaction
- Elimination (E1 , E2)
- Cationic
- Hydrolysis
- Addition
- Radical reaction

Important named reactions:

- **Halo-Alkane:** from alkyl halide
- **Friedel-Crafts:** alkyl or acyl group
- **Grignard:** alkyl or acyl group
- **Witt-Renbaum, Clemmensen:** reduce ketone to alkane
- **Wittig:** convert aldehyde/ketone to alkene

KINETICS AND REACTION MECHANISM



Transition state (TS): Maximum on the reaction coordinate curve; the least stable intermediate.

Activation Energy (E_a): Energy of the TS relative to the reactants. The change in enthalpy (ΔH) is $-E_a$ for exothermic, $+E_a$ for endothermic.

Hammett-Lippert postulate: The TS is more like the reactant or product that is closer in energy. endothermic TS is like the product, exothermic TS is like the reactant.

Kinetic vs. thermodynamic control: (a) and (b) describe Thermodynamic control.

• If (a) is large and negative (exergonic), the product formation is likely controlled by "thermodynamic". Large K_{eq} corresponds to a large amount of product, relative to reactant.

• A large E_a may give rise to "kinetic" control; the energy of the TS controls the reaction, instead of the product-reactant thermodynamics.

Solvent effects: A solvent may stabilize an intermediate, decreasing E_a and increasing the rate of the reaction. Charge-complexes are stabilized by polar solvents.

ORGANIC ACID AND BASE

Acid:

- Electrophile: accepts δ^- ions acids
- Proton donor (Brønsted-Lowry acid)
- example: carboxylic acid

Base:

- Electrophile donor (Lewis base)
- Proton acceptor (Brønsted-Lowry base)
- example: amine

Factors enhancing acid strength (H-A):

- Medium H-A bond
- Greater electronegativity of "A"
- Inductive effect of substituents on "A" (electron withdrawal enhances transfer)
- More "s" character in hybrid orbital involved in bond to group that is pulled
- Resonance stabilization conjugate base (A^-)

Factors enhancing base strength:

- Resonance of conjugate acid/bases
- A base is a nucleophile. Electrons effects which shift electron density to the atom with the lone-pair increases base strength.

ALKANE

Properties:

- Hydrocarbon
- Weak intermolecular forces
- Non-polar, general formula $\text{C}_n\text{H}_{2n+2}$
- Saturated C-C (sp^3)

Nomenclature:

- Add "-ane" to prefix
- Lowest substituents by priority
- Halohalogen: substitute halide for H

Cycloalkane (C_nH_{2n}):

- Bicyclic: two fused or bridged rings
- $n = 3$: cyclopropane (highly strained)
- $n = 4$: cyclobutane (some flexibility)
- $n = 5$: cyclopentane (slight puckering)
- $n = 6$: cyclohexane: chair = stable conformation
- Axial: less stable, axial position, "perpendicular" to ring. Equatorial position, in ring "plane"
- Cis: two substituents on up position
- Trans: one up and one down



Synthesis:

- Hydrogenate alkene or alkyne (H_2 , Pt catalyst)
- Free-radical reaction of alkene
- Radical halohalogen (Br_2 , H_2)
- Friedel-Crafts alkylation

Reaction:

- Combustion: alkane + $\text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- Halogenation to haloalkane ($\text{C}_n\text{H}_{2n+2}$, light or heat)

ALKENE $>\text{C}=\text{C}<$

Properties: Similar to alkane, non-polar, flammable

Nomenclature:

- Add "-ene" to prefix, Use E to denote $\text{C}=\text{C}$ position
- Saturated C-C (sp^3), unsaturated C=C (sp^2)
- Polyunsaturated: alkyl with 2 or more C=C
- Alkene: adjacent C-C
- Vinyl group: $\text{H}_2\text{C}=\text{CH}-$
- Methylene group: $\text{H}_2\text{C}-$
- Allyl group: $\text{H}_2\text{C}=\text{CH}-\text{CH}_2-$
- Vinyl halide: halide replaces H on $\text{C}=\text{C}$
- Conjugated: adjacent C=C and C-C (conjugated)
- Alkadiene, 2 conjugated C=C , example: butadiene, cis and trans isomers about C-C bonds
- Alkydiene, 1 conjugated C=C
- Aromatic: conjugated monocyclic compound, example: (H) arenes = benzene
- Aromatic: cyclic, non-cyclopentadiene anion, cyclopentadienyl anion (δ^- electron)

Isomers: no free rotation of C=C



- E/Z: priority groups by atomic weight of - higher priority groups on the same side
- For molecules, cis is less stable (more branching), the opposite, cis more stable
- **Hydrogen Hake:** from the least substituted alkene
- **Markovnikov addition:** H adds to C^+ with more H's
- **Zaitsev Elimination:** from alkene with more substitution

Synthesis:

- Dehydration: alcohol (OH^- , heat) (elimination)
- Dehydrohalogenation: haloalkane (base, heat)
- Dehalogenation: vic. dihalide (Zn , acidic aq.)
- Hydrogenation: alkene
- cis , Diels-Alder (H_2 , Pt catalyst)
- trans , Diels-Alder (O_3 , H_2 , Pt)
- Wittig, aldehyde/ketone + phosphorus ylide

Reaction:

- Combustion: alkyl
- Hydrogen to H^+ alcohol (H^+ , H_2O , Pt from alkene, see nomenclature (Markovnikov))
- Hydrogen to alcohol: hydrohalogenation (acid, heat) (HBr , H_2O , $\text{H}_2\text{SO}_4/\text{CH}_3\text{COOH}$, see Markovnikov)
- Hydrohalogenation: to alcohol
- Hydrohalogenation: alkyl (Markovnikov)
- Halogenation ($\text{Br}_2/\text{H}_2\text{O}$, vic. dihalide ($\text{N}_2\text{O}/\text{CH}_3\text{COOH}$, see Markovnikov)
- Hydrohalogenation (H_2 , H_2O , see addition)
- Hydrohalogenation to form a 1,2-diol (KMnO_4 , acid (OH), see addition)
- Oxidation to carboxylic acid (KMnO_4 , heat (OH))
- Oxidation to ketone (O_3 , Zn , H_2O)
- Hydrogenation to alkane (H_2 , Pt , see addition)
- Free-radical polymerization
- Alkylation: Reaction
- alkyl halogenation (CH_3 , heat)
- Diels-Alder: cycloaddition from diene + alkene/alkyne

Organic Chemistry Reactions Quickstudy Academic

Mark Jackson



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Online Questions and Quick Study Review Barron's Educational Series, Mark Kernion, Joseph A. Mascetta, 2022-07-05 Barron's Chemistry Practice Plus features more than 400 online practice questions and a concise review guide that covers the basics of Chemistry Inside you ll find concise review on the basics of Chemistry an excellent resource for students who want a quick review of the most important topics access to 400 online questions arranged by topic for customized practice online practice includes answer explanations with expert advice for all questions plus scoring to track your progress This essential guide is the perfect practice supplement for students and teachers **Pp/Chemistry** BarCharts, Inc., 2008-06-18 *Organic*

Chemistry Reactions BarCharts, Inc., 2015 CLASS 10 SCIENCE EXPLORER The Quick Study Punam Maggon, 2026-01-08 This book is based on the CBSE curriculum and aims to provide students with a clear and concise understanding of key scientific concepts It contains the definitions of various terms that students need to learn to better grasp the subject matter and apply it effectively in their studies By offering simplified explanations this book serves as a valuable tool for quick revision helping students strengthen their foundational knowledge In addition to the theoretical content the book incorporates a variety of illustrations and diagrams to make the learning process more engaging and visually appealing The inclusion of these visuals helps to break down complex ideas into easily digestible chunks and fosters a deeper understanding of the material Each chapter is carefully structured to present the facts and concepts in a straightforward and approachable manner ensuring that even challenging topics are made simple for students to comprehend It is my firm belief that science when taught interactively and engagingly becomes not just a subject to study but a fascinating journey of discovery With this in mind I have tried to create a resource that not only helps students excel academically but also sparks their curiosity and encourages them to explore the world around them I sincerely hope that this book will prove to be a useful companion for students and teachers alike offering both clarity and inspiration Punam Maggon **Organic Chemistry Fundamentals**

Mark Jackson, 2015-12-31 Quick Reference for the core essentials of a subject and class that is challenging at best and that many students struggle with In 6 laminated pages our experienced chemistry author and professor gathered key elements

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Organic Chemistry Reactions Mark Jackson, 2001-09-19 This guide is packed with useful and up to date information regarding Organic Chemistry Reactions The laminated 4 page guide contains information on features of an organic reaction kinetics reaction mechanism organic acid base benzene arene alkyne alcohol and much more *ADVANCED ORGANIC CHEMISTRY: REACTIONS, MECHANISMS AND STRUCTURE, 4TH ED* March, 2006 Market_Desc Professors in Organic Chemistry Students in Organic Chemistry Organic Chemists Special Features The book Describes the structure of organic compounds including chemical bonding and stereochemistry Reviews general reaction mechanisms including ordinary reactions and photochemical reactions Includes a survey of reactions arranged by reaction type and by which bonds are broken and formed Includes IUPAC s newest system for designating reaction mechanisms Features an index to the methods used for preparing given types of compounds Contains more than 15 000 references 5 000 new to this edition to original papers About The Book The book covers the three fundamental aspects of the study of organic chemistry reactions mechanisms and structure Part One explores the structure of organic compounds providing the necessary background for understanding mechanisms Part Two discusses reactions and mechanisms Organized by reaction type each of these chapters discusses the basic mechanisms along with reactivity and orientation as well as the scope and mechanisms of each reaction Organic Chemistry Fundamentals BarCharts, Inc, 2015 **Understanding Organic**

Reaction Mechanisms Adam Jacobs, 1997-07-17 This book describes the principles that govern chemical reactivity and shows how these principles can be used to make predictions about the mechanisms and outcomes of chemical reactions Molecular orbital theory is used to provide up to date explanations of chemical reactivity in an entirely nonmathematical approach suited to organic chemists A valuable section explains the use of curly arrows vital for describing reaction mechanisms An entire chapter is devoted to exploring the thought processes involved in predicting the mechanisms of unfamiliar reactions Each chapter is followed by a summary of the important points and a selection of problems to help the reader make sure that the material in that chapter has been assimilated The book concludes with a comprehensive glossary of technical terms This text will be of interest to first and second year chemistry undergraduates studying organic chemistry

A Self-study Guide to the Principles of Organic Chemistry Jiben Roy, 2013 A Self Study Guide to the Principles of Organic Chemistry Key Concepts Reaction Mechanisms and Practice Questions for the Beginner will help students new to organic chemistry grasp the key concepts of the subject quickly and easily as well as build a strong foundation for future

study Starting with the definition of atom the author explains molecules electronic configuration bonding hydrocarbons polar reaction mechanisms stereochemistry reaction varieties organic spectroscopy aromaticity and aromatic reactions biomolecules organic polymers and a synthetic approach to organic compounds The over one hundred diagrams and charts contained in this volume will help students visualize the structures and bonds as they read the text and make the logic of organic chemistry clear and easily understood Each chapter ends with a list of frequently asked questions and answers followed by additional practice problems Answers are included in the Appendix

Advanced Organic Chemistry Jerry March, 1985 This survey of advanced chemistry covers virtually all the useful reactions 600 all told with the scope limitations and mechanism of each described in detail Extensive general sections on the mechanisms of the important reaction types and five chapters on the structure and stereochemistry of organic compounds and reactive intermediates are included as well Of the more than 10 000 references included 5 000 are new in this edition

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Named Organic Reactions

Thomas Laue, Andreas Plagens, 2005-08-19 This Second edition contains concise information on 134 carefully chosen named organic reactions the standard set of undergraduate and graduate synthetic organic chemistry courses Each reaction is detailed with clearly drawn mechanisms references from the primary literature and well written accounts covering the mechanistic aspects of the reactions and the details of side reactions and substrate limitations For the 2nd edition the complete text has been revised and updated and four new reactions have been added Baylis Hillmann Reaction Sonogashira Reaction Pummerer Reaction and the Swern Oxidation and Cyclopropanation An essential text for students preparing for exams in organic chemistry

Summary of International Energy Research and Development Activities Smithsonian Science Information Exchange, 1974

Advanced Organic Chemistry: Reactions and Mechanisms Singh, Maya Shankar, 2004 Advanced Organic Chemistry Reactions and Mechanisms covers the four types of reactions substitution addition elimination and rearrangement the three types of reagents nucleophiles electrophiles and radicals and the two effects electronic

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