

Reactions of Amines and Epoxydes

Preparation of Amines

Ammonium hydroxide: $\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$



Four different types of bonds



There are four types of bonding between atoms in a molecule.

- Ionic bonds are formed by the transfer of electrons from one atom to another (anions and cations) (Opposite charges).



Opposites attract and like dissolves like

Opposites attract and like dissolves like (London) bonding of atoms.

- Covalent bonds are formed by sharing of electrons between two atoms.
- Very simple bond is a covalent bond.
- Non-polar covalent bonds consist of two opposites and two like.



Polar bonds are stronger than non-polar.

Polar and Nonpolar Covalent Bonds



- If the difference in electronegativity is less than 0.4, the electrons are shared equally between the two atoms. Forming a nonpolar covalent bond (like a covalent bond between chlorine atoms for the C-C and C-Cl bonds).
- If the difference in electronegativity is between 0.5 and 1.7, one atom has a partial negative charge and the other has a partial positive charge (like a polar covalent bond between oxygen and carbon in a water molecule H₂O and other halogens).
- A difference of 1.7 or higher one or both of the atoms have a larger share and a polar bond is formed.

A Summary of Ring-Opening Reactions of Epoxydes with Strong and Weak Protagonists

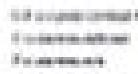


Protagonists and Reactions

Bond Types, Strength, Length, Polarity and Dipole Moment

Dipole Moment

The polarity of a bond is denoted by the dipole moment (μ).



Directional dipole moment of the covalent bond.

- The dipole moment is shown as a vector pointing from the less electronegative atom to the more electronegative atom.
- The vector is proportional to the partial negative charge and the partial positive charge.
- The dipole plot indicates the charge difference.
- The dipole moment is shown as a horizontal arrow.

Molecular Dipole

To measure the molecular polarity, the sum of the dipole is used.

The polarity of the molecule is equal to the sum of the bond dipole moments. If the dipole moments are equal, it is a polar molecule.



Sum of the bond dipole moment of the molecule.

Bond Length and Bond Strength

Reactions of bond length



Length: 1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å.

Strength: 1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å.

Ionic radius: 1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å.

Nonpolar covalent bond: 1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å.

Polar covalent bond: 1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å.

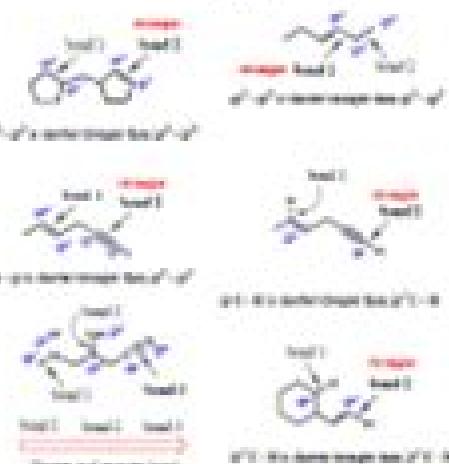
Reactions of bond strength

Average values of C-C and C-H bond depending on hybridization

C-C Bond	$\text{H}_2\text{C}-\text{CH}_3$	$\text{H}_2\text{C}=\text{CH}_2$	$\text{CH}_3\text{CH}_2\text{CH}_3$
Hybridization	sp^3 hybrid	sp^2 hybrid	sp^3 hybrid
Length	1.54 Å	1.35 Å	1.53 Å
Strength	1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å	1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å	1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å
Hybridization	sp^3	sp^2	sp^3 , sp^2
Strength	1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å	1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å	1.07 Å, 1.27 Å, 1.42 Å, 1.62 Å

Higher the bond length and stronger bond

Example



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Table of Contents Organic Chemistry Forth Edition Study Guide

1. Understanding the eBook Organic Chemistry Forth Edition Study Guide
 - The Rise of Digital Reading Organic Chemistry Forth Edition Study Guide
 - Advantages of eBooks Over Traditional Books
2. Identifying Organic Chemistry Forth Edition Study Guide
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Organic Chemistry Forth Edition Study Guide
 - User-Friendly Interface
4. Exploring eBook Recommendations from Organic Chemistry Forth Edition Study Guide
 - Personalized Recommendations
 - Organic Chemistry Forth Edition Study Guide User Reviews and Ratings
 - Organic Chemistry Forth Edition Study Guide and Bestseller Lists

5. Accessing Organic Chemistry Forth Edition Study Guide Free and Paid eBooks
 - Organic Chemistry Forth Edition Study Guide Public Domain eBooks
 - Organic Chemistry Forth Edition Study Guide eBook Subscription Services
 - Organic Chemistry Forth Edition Study Guide Budget-Friendly Options
6. Navigating Organic Chemistry Forth Edition Study Guide eBook Formats
 - ePUB, PDF, MOBI, and More
 - Organic Chemistry Forth Edition Study Guide Compatibility with Devices
 - Organic Chemistry Forth Edition Study Guide Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Organic Chemistry Forth Edition Study Guide
 - Highlighting and Note-Taking Organic Chemistry Forth Edition Study Guide
 - Interactive Elements Organic Chemistry Forth Edition Study Guide
8. Staying Engaged with Organic Chemistry Forth Edition Study Guide
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Organic Chemistry Forth Edition Study Guide
9. Balancing eBooks and Physical Books Organic Chemistry Forth Edition Study Guide
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Organic Chemistry Forth Edition Study Guide
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Organic Chemistry Forth Edition Study Guide
 - Setting Reading Goals Organic Chemistry Forth Edition Study Guide
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Organic Chemistry Forth Edition Study Guide
 - Fact-Checking eBook Content of Organic Chemistry Forth Edition Study Guide
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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