

Reactions of Amines and Epoxides

Preparation of Amines

Amines are colorless, basic, and have a strong odor. They are prepared by the reduction of nitriles.



A summary of Ring-Opening Reactions of Epoxides with Strong and Weak Nucleophiles



Epoxide Reactions and Mechanisms

Bond Types, Strength, Length, Polarity and Dipole Moment

Free-radical halogenation



There are two types of bonding: ionic bonding and covalent bonding.

- Ionic bonds are formed by the transfer of electrons from one element to another (ionization potential) and electron affinity (electron).



- Covalent bonds are formed by sharing of electrons between two atoms.



The Relative Electronegativity of Atoms



Bond and Bonding in Molecules



Bonding in Molecules



There are two types of bonding:

1. Ionic bonding



Sigma and pi bonds

Covalent bonds are classified as sigma and pi bonds.

- Sigma bonds are formed by head-on overlap of orbitals.
- pi bonds are formed by side-on overlap of orbitals.

- A single bond is a sigma bond.
- A double bond consists of one sigma and one pi bond.



pi bonds are stronger than sigma bonds.

Polar and Nonpolar Covalent Bonds

Depending on the difference in the electronegativity of the atoms, covalent bonds can be polar and nonpolar.



- If the difference in electronegativity is less than 0.5, the electrons are shared equally (nonpolar bond).
- If the difference in electronegativity is between 0.5 and 1.7, the electrons are shared unequally (polar bond).
- If the difference in electronegativity is greater than 1.7, the electrons are not shared (ionic bond).

- A difference of 0.5 or higher can be high for the electrons are not shared (ionic bond).
- A difference of 1.7 or higher can be high for the electrons are not shared (ionic bond).

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Dipole Moment

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



- The dipole moment is a vector pointing from the less electronegative atom to the more electronegative atom.
- The more electronegative atom has a partial negative charge (δ⁻) and the less electronegative atom has a partial positive charge (δ⁺).
- δ⁻ (delta minus) indicates an electron deficient atom.
- δ⁺ (delta plus) indicates an electron rich atom.

Molecular Dipole

To determine the molecular polarity, the vector sum of the dipoles is used.

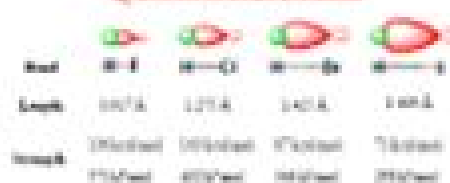
The geometry of the molecule is important. Symmetrical molecules are nonpolar (zero net dipole moment) and asymmetrical molecules are polar (non-zero net dipole moment).



Consider the vector sum of the dipoles for each molecule.

Bond Length and Bond Strength

The length of a bond is the distance between the nuclei of the two atoms.



Double bonds are stronger than single bonds and are shorter.

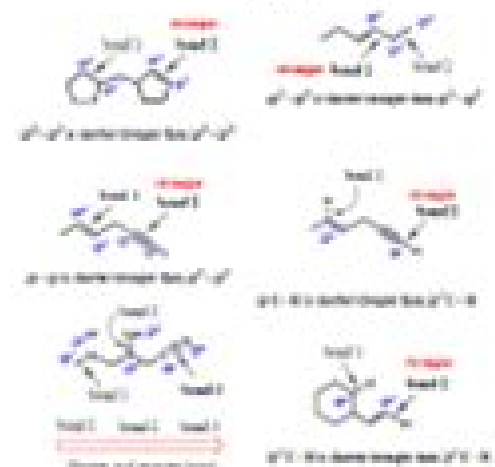


The length of a bond is the distance between the nuclei of the two atoms.

Average values of C-C and C-H bonds depending on hybridization			
C-C Bond	sp ³ -C	sp ² -C	sp-C
Hybridization	sp ³ -sp ³	sp ² -sp ²	sp-sp
Length	1.54 Å	1.34 Å	1.20 Å
Strength	33 kcal/mol	112 kcal/mol	200 kcal/mol
Hybridization	sp ³ -sp ³	sp ² -sp ²	sp-sp
C-H Bond	sp ³ -H	sp ² -H	sp-H
Length	1.09 Å	1.08 Å	1.06 Å
Strength	98 kcal/mol	110 kcal/mol	120 kcal/mol

Higher s character = stronger and shorter bond

Examples



Organic Chem Final Study Guide

N. Sue Barnes



Organic Chem Final Study Guide:

Study Guide and Solutions Manual for Fundamentals of Organic Chemistry Susan McMurry, 1994 Following a brief review of structure and bonding organic molecules and functional groups are presented as early as possible The text is organized primarily by functional group beginning with simple alkanes and moving toward more complex compounds Emphasis is placed on the fundamental mechanistic similarities of organic reactions McMurry's thorough revision continues to present the solid content necessary for this course without sacrifice of important subjects and pedagogical tools Text and reaction summaries full problem sets and outstanding artwork are just some of the features in the Third Edition usually found in a full year book McMurry's clear well written explanations remain a highlight of the book **Study Guide with Solutions to Accompany Burgoyne, A Study Course in Organic Chemistry** N. Sue Barnes, 1979 *Almond Books* *Chemistry Study Guide for ICSE Class 10 for 2024 Exam - Chapterwise & Categorywise Notes, ICSE School Prelims, MCQs, Previous Years Board Questions, Fully Solved* Almond Books, **Class 10 Chemistry Questions and Answers PDF** Arshad Iqbal, The Class 10 Chemistry Quiz Questions and Answers PDF Grade 10 Chemistry Competitive Exam Questions Chapter 1 10 Practice Tests Class 10 Chemistry Textbook Questions for Beginners includes revision guide for problem solving with hundreds of solved questions Class 10 Chemistry Questions and Answers PDF book covers basic concepts analytical and practical assessment tests Class 10 Chemistry Quiz PDF book helps to practice test questions from exam prep notes The Grade 10 Chemistry Quiz Questions and Answers PDF eBook includes revision guide with verbal quantitative and analytical past papers solved tests Class 10 Chemistry Questions and Answers PDF Free download chapter 1 a book covers solved common questions and answers on chapters Acids bases and salts biochemistry characteristics of acids bases and salts chemical equilibrium chemical industries environmental chemistry atmosphere water hydrocarbons and organic chemistry tests for school and college revision guide Chemistry Interview Questions and Answers PDF Download free eBook's sample covers beginner's solved questions textbook's study notes to practice online tests The Class 10 Chemistry Interview Questions Chapter 1 10 PDF book includes high school question papers to review practice tests for exams Class 10 Chemistry Practice Tests a textbook's revision guide with chapters tests for NEET MCAT GRE GMAT SAT ACT competitive exam 10th Grade Chemistry Questions Bank Chapter 1 10 PDF book covers problem solving exam tests from chemistry textbook and practical eBook chapter wise as Chapter 1 Acids Bases and Salts Questions Chapter 2 Biochemistry Questions Chapter 3 Characteristics of Acids Bases and Salts Questions Chapter 4 Chemical Equilibrium Questions Chapter 5 Chemical Industries Questions Chapter 6 Environmental Chemistry I Atmosphere Questions Chapter 7 Environmental Chemistry II Water Questions Chapter 8 Hydrocarbons Questions Chapter 9 Organic Chemistry Questions Chapter 10 Atmosphere Questions The Acids Bases and Salts Quiz Questions PDF e Book Chapter 1 interview questions and answers on acids and bases concepts Bronsted concept of acids and bases pH scale and salts The Biochemistry Quiz Questions PDF e Book Chapter 2 interview

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