

Reactions of Amines and Epoxides

Preparation of Amines

Amines are colorless, basic, and have a strong, fishy odor.



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



Regioselectivity and Stereochemistry

Bond Types, Strength, Length, Polarity and Dipole Moment

Two types of covalent bond

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

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



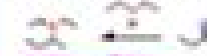
- Covalent bonds are formed by sharing of electrons between two atoms.



The difference between ionic and covalent bonds



Bond and Bonding energy



Bonding energy



There are two types of covalent bond

Definition of ionic and covalent bond



Sigma and pi bonds

Covalent bonds are classified into 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 values, 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 1.7 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).

Dipole Moment

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



- The dipole moment is defined as a vector pointing from the less electronegative to the more electronegative atom.
- The vector dipole moment is a vector pointing from the less electronegative to the more electronegative atom.
- μ (dipole moment) indicates an electron shift from one atom to another.
- μ (dipole moment) indicates an electron shift from one atom to another.

Molecular Dipole

To determine the molecular polarity, the vector sum of the dipole moments.

The polarity of the molecule is determined by the vector sum of the dipole moments. A good example is carbon dioxide.



Carbon dioxide is a linear molecule with no net dipole moment.

Bond Length and Bond Strength

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



Double bonds are stronger than single bonds.

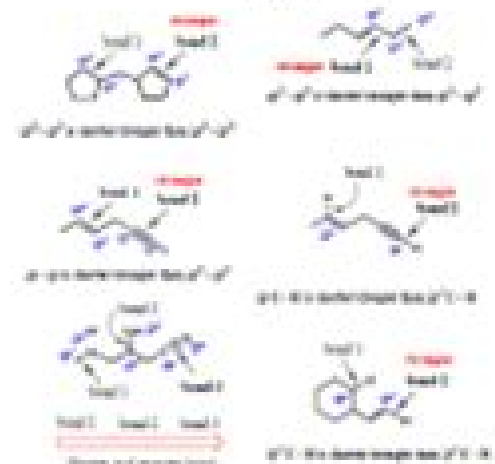


The bond length is the distance between the nuclei of the two atoms.

Average values of C-C and C-H bonds depending on hybridization			
C-C Bond	sp^3-sp^3	sp^2-sp^2	$sp-sp$
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	47 kcal/mol	58 kcal/mol
Hybridization	sp^3-sp^3	sp^2-sp^2	$sp-sp$
C-H Bond	sp^3-sp^3	sp^2-sp^2	$sp-sp$
Length	1.54 Å	1.34 Å	1.20 Å
Strength	33 kcal/mol	47 kcal/mol	58 kcal/mol

Higher s character means stronger bond

Example



giving information on the strength of the bond.



Pavia Organic Chemistry Lab Study Guide

Albert A Gayle



Pavia Organic Chemistry Lab Study Guide:

Organic Laboratory Experiments of the Future Bruce H. Lipshutz, Hubert Muchalski, 2025-12-05 This lab manual offers students the opportunity to learn organic chemistry through a green chemistry lens resulting in a more sustainable future looking course Lipshutz and Muchalski's Organic Laboratory Experiments of the Future Doing Chemistry in Water approaches the subject with experiments diagrams and illustrations shaped by student feedback and honed through years of research and laboratory experience Organic Laboratory Experiments of the Future Doing Chemistry in Water includes material on reactions run in water including but not limited to ppm Pd catalyzed couplings SNAr reactions nitro group reductions enzyme catalyzed reactions catalytic hydrogenation of olefins olefin metathesis reductive aminations and chemoenzymatic sequences This lab manual is ideal for courses in organic chemistry biochemistry sustainable and green chemistry and environmentally responsible lab courses Provides practical information and techniques for utilizing green chemistry and chemistry in water in particular in the study of modern organic chemistry Includes numerous figures examples illustrative problems and appendices that reinforce laboratory concepts and methods Features coverage on experiments that focus on chemocatalysis as well as biocatalysis reactions that include Nobel Prize winning organometallic chemistry multi step sequences involving chemocatalysis or chemoenzymatic catalysis

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