

Reactions of Amines and Epoxydes

Preparation of Amines

Ammonium chlorides: $\text{NH}_4^+ + \text{H}_3\text{N}^- \rightarrow \text{NH}_3 + \text{NH}_4^+$



Four different types of bonds

1. Ionic bond
2. Covalent bond
3. Hydrogen bond
4. Metallic bond

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

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



The covalent bonding of two atoms

$\text{O}=\text{C}=\text{O}$

Shared and transferred electrons

H_2

Hydrogen bonding

H_2O

Electron transfer

Na^+

Metallic bonding

Na^+

Hydrogen bonding

H_2O

Electron transfer

Na^+

Hydrogen bonding

H_2O

Electron transfer

Na^+

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



Protagonists and Protagonists

Bond Types, Strength, Length, Polarity and Dipole Moment

Dipole Moment

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

1. 100% covalent bond
2. 50% covalent bond
3. 0% covalent bond



Electrostatic map of the dipole moment.

- The dipole moment is shown as a vector pointing from the less electronegative bond to the more electronegative atom.
- The vector is longer if there is a partial negative charge and the less electronegative atom is a partial positive charge atom.
- The dipole plot indicates the charge difference.
- The dipole moment is shown as a distance and angle.

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 moment is measured, it just enough to notice.



Sum of the bond dipole moment of the molecule.

Dependence of dipole moment on bond length

Dependence of dipole moment on bond length.

Polar and Nonpolar Covalent Bonds

Dependence on the difference in the electronegativity of atoms, polar bonds are polar and nonpolar.

Nonpolar Covalent Bonds

Dependence on the difference in the electronegativity of atoms, nonpolar bonds are nonpolar.

Polar Covalent Bonds

Dependence on the difference in the electronegativity of atoms, polar bonds are polar.

Nonpolar Covalent Bonds

Dependence on the difference in the electronegativity of atoms, nonpolar bonds are nonpolar.

Polar Covalent Bonds

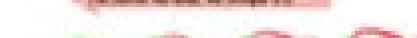
Dependence on the difference in the electronegativity of atoms, polar bonds are polar.

Nonpolar Covalent Bonds

Dependence on the difference in the electronegativity of atoms, nonpolar bonds are nonpolar.

Bond Length and Bond Strength

Dependence on bond length.



Bond length: $\text{H}_2\text{O} < \text{H}_2\text{S} < \text{H}_2\text{Se} < \text{H}_2\text{Te}$

Bond strength: $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se} > \text{H}_2\text{Te}$

Nonpolar covalent bonds are shorter and stronger than polar covalent bonds.

Polar covalent bonds are longer and weaker than nonpolar covalent bonds.

Nonpolar covalent bonds are shorter and stronger than polar covalent bonds.

Polar covalent bonds are longer and weaker than nonpolar covalent bonds.

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Nonpolar covalent bonds are shorter and stronger than polar covalent bonds.

Polar covalent bonds are longer and weaker than nonpolar covalent bonds.

Dependence on bond length.

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

C-C bond: $\text{sp}^2 = 1.35 \text{ \AA}$, $\text{sp}^3 = 1.47 \text{ \AA}$, $\text{sp} = 1.30 \text{ \AA}$

Hybridization: $\text{sp}^2 = 1.35 \text{ \AA}$, $\text{sp}^3 = 1.47 \text{ \AA}$, $\text{sp} = 1.30 \text{ \AA}$

Length: $\text{sp}^2 = 1.35 \text{ \AA}$, $\text{sp}^3 = 1.47 \text{ \AA}$, $\text{sp} = 1.30 \text{ \AA}$

Strength: $\text{sp}^2 = 100 \text{ kJ/mol}$, $\text{sp}^3 = 117 \text{ kJ/mol}$, $\text{sp} = 107 \text{ kJ/mol}$

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Dependence on bond length and strength.

Dependence on bond length.

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 catalysts.

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