

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 electron from one atom to another (anions and cations) (Opposite charges).



Opposites attract and like goes with like

- Opposites attract and like goes with like (Attraction of atoms).
- Covalent bonds are formed by sharing of electrons between two atoms.
- Very simple bond is a covalent bond.
- Four covalent bonds between two oxygen atoms (O2).



Long bonds are stronger than short bonds.

Strength of different bonds

Ionic bonds



Covalent bonds



Hydrogen bonds



Metallic bonds



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

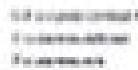


Reactions and Mechanisms

Bond Types, Strength, Length, Polarity and Dipole Moment

Dipole Moment

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



Electronegativity is the ability of an atom to attract electrons.

- The dipole moment is shown as a vector pointing from the less electronegative atom towards the more electronegative atom.
- The vector is proportional to the partial negative charge and the distance between a partial positive charge and a partial negative charge.
- 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 molecular dipole moments. If the dipole moments are equal, it is just simple addition.



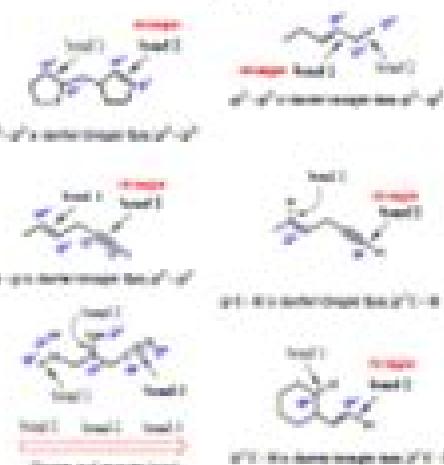
Sum of vector of the bond dipole for the molecule.

Average values of C-C and C-H bond dipole moment in molecules

C-C Bond	$\text{H}_2\text{C}-\text{CH}_3$	$\text{CH}_2=\text{CH}_2$	CH_3CH_3
Hybridization	sp^3 hybrid	sp^2 hybrid	sp^3 hybrid
Length	1.17 Å	1.35 Å	1.35 Å
Strength	0.16 kcal/mol	0.17 kcal/mol	0.17 kcal/mol
Hybridization	sp^3	sp^2	sp^3
Strength	0.16 kcal/mol	0.17 kcal/mol	0.17 kcal/mol
Length	1.17 Å	1.35 Å	1.35 Å
Strength	0.16 kcal/mol	0.17 kcal/mol	0.17 kcal/mol

Dipole moment vector and stronger bond

Example



Bond Length and Bond Strength

Relative bond length and strength

Bond	Relative bond length	Relative bond strength
Na-Cl	0.21 Å	0.16 kcal/mol
Na-O	1.27 Å	0.17 kcal/mol
Na-F	1.47 Å	0.16 kcal/mol
Na-H	1.35 Å	0.17 kcal/mol
Na-Cl	0.21 Å	0.16 kcal/mol
Na-O	1.27 Å	0.17 kcal/mol
Na-F	1.47 Å	0.16 kcal/mol
Na-H	1.35 Å	0.17 kcal/mol

Na-O is longer than Na-Cl but stronger than Na-Cl.

Na-F is longer than Na-O but stronger than Na-O.

Na-H is longer than Na-F but stronger than Na-F.

Relative bond length and strength

Relative bond length and strength

Organic Chemistry 3a Study Guide

Ensheng Dong

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