

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).



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



Region (p) and p-orbital bonds

- Covalent bonds are classified as region (p) and p-orbital.
- Region bonds are formed by bond between two atoms.
- p bonds are formed by side-on overlap of orbitals.
- Very simple bond is a covalent bond.
- Non-overlapping bond consists of two regions and two p-orbitals.



Region bonds are stronger than p-orbital.

Definition of Amino acid

Amino acids



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

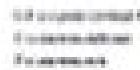


Reactions and Mechanisms

Bond Types, Strength, Length, Polarity and Dipole Moment

Dipole Moment

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



Electronegativity is related to the dipole moment.

- 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 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 total 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 just simple to calculate.



Sum the vector of the bond dipole for the molecule.

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

C-C Bond	sp_2-sp_2	sp_3-sp_3	$\text{sp}-\text{sp}$
Hybridization	sp^2-sp^2	sp^3-sp^3	$\text{sp}-\text{sp}$
Length	1.37 Å	1.54 Å	1.35 Å
Strength	1.01 kcal/mol	0.77 kcal/mol	0.77 kcal/mol
Hybridization	sp^2	sp^3	sp
Efficiency	25.7% 25.7%	25.7% 25.7%	25.7% 25.7%
Length	1.37 Å	1.54 Å	1.35 Å
Strength	1.01 kcal/mol 0.77 kcal/mol	0.77 kcal/mol 0.77 kcal/mol	0.77 kcal/mol 0.77 kcal/mol

Dipole moment and bond length

Example



$\text{dipole} = \text{length} \times \text{strength}$

Bond Length and Bond Strength

Relative bond length



Bond length: $\text{C-C} > \text{C=O} > \text{C=C} > \text{C=O}$

Strength: $\text{C-C} < \text{C=O} < \text{C=C} < \text{C=O}$

Efficiency: $\text{C-C} < \text{C=O} < \text{C=C} < \text{C=O}$

Partial negative charge: $\text{C-C} < \text{C=O} < \text{C=C} < \text{C=O}$

Partial positive charge: $\text{C-C} < \text{C=O} < \text{C=C} < \text{C=O}$

Relative bond strength



Relative bond to water



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