

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

Electrostatic interactions

Na^+

Metals

Mg^{2+}

Hydrogen bonding

H_2O

Hydrogen bonding

H_2O

Hydrogen bonding

H_2O

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



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).

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



Electron density is indicated by the density of the electron cloud.

- The dipole moment is shown as a vector pointing from the less electronegative bond 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 sum of the dipole is used.

The polarity of the molecule is equal to the sum of molecular dipole moments. The dipole moment is measured. A good example is water, which has a dipole moment of 1.85 D.



Sum of the bond dipole moment for the water.

Bond Length and Bond Strength

Reactions of bond length and strength



Bond: $\text{Na}^+ - \text{Cl}^-$ $\text{H} - \text{O}$ $\text{H} - \text{O}$ $\text{Mg}^{2+} - \text{O}$

Length: 2.27 Å 1.21 Å 1.47 Å 1.66 Å

Strength: 100% 50% 0% 100%

100% 50% 0% 100%

100% 50% 0% 100%

100% 50% 0% 100%

100% 50% 0% 100%

100% 50% 0% 100%

100% 50% 0% 100%

100% 50% 0% 100%

Reactions of bond length and strength

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

C-C bond: $\text{H}_2\text{C}=\text{CH}_2$ $\text{H}_2\text{C}=\text{CH}_2$ CH_3CH_3

Hybridization: sp^2 sp^2 sp^3

Length: 1.37 Å 1.35 Å 1.39 Å

Strength: 100% 50% 100% 50%

100% 50% 100% 50%

Hybridization: sp^2 sp^2 sp^3

Strength: 100% 50% 100% 50%

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Length: 1.39 Å 1.39 Å 1.39 Å

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Length: 1.39 Å 1.39 Å 1.39 Å

Strength: 100% 50% 100% 50%

100% 50% 100% 50%

Electrostatic interactions

H_2O

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John E. McMurry, Susan McMurry

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