

# 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

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).

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



Hydrogen bond and pi (π) bonds

- Hydrogen bonds are formed by partial ionic bonding of atoms.
- π bonds are formed by side-on bonding of atoms.
- π bonds form in a pi bond.
- π bonds form between two regions of two regions and two atoms.



There are two main categories of bonds: ionic and covalent.

Depend on the difference in electronegativity.

Depend on the difference in the electronegativity of atoms, covalent bonds are formed by polar and nonpolar.

- If the difference in electronegativity is less than 0.4, the electrons are shared equally between the two atoms. Forming a nonpolar covalent bond. (Nonpolar examples are the C-C and C-H bonds).
- If the difference in electronegativity is between 0.5 and 1.7, the more polar covalent bond. Nonpolar examples are the carbon-carbon in N<sub>2</sub>, O<sub>2</sub>, F and other halogens.
- If a difference of 1.7 or higher one or both of the atoms have a larger share and a polar bond is formed.

## 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 ( $\mu$ ).



Direction of the dipole moment is from the positive to the negative end.

- The dipole moment is shown as a vector pointing from the less electronegative 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 the bond dipole moments. If the dipole moments are equal, it is just simple addition.



Sum of the bond dipole moment for the molecule.

Average values of C-C and C-H bond depending on the molecule			
C-C bond	$\text{H}_2\text{C}-\text{CH}_3$	$\text{H}_2\text{C}=\text{CH}_2$	$\text{CH}_3\text{CH}_2\text{CH}_3$
Hybridization	$\text{sp}^3$ (sp <sup>3</sup> )	$\text{sp}^2$ (sp <sup>2</sup> )	$\text{sp}$ (sp)
Length	1.54 Å	1.35 Å	1.10 Å
Strength	1.01 kcal/mol	1.11 kcal/mol	2.01 kcal/mol
Hybridization	$\text{sp}^3$	$\text{sp}^2$	$\text{sp}$
Hybridization	$\text{sp}^3$	$\text{sp}^2$	$\text{sp}$
Strength	1.01 kcal/mol	1.11 kcal/mol	2.01 kcal/mol
Length	1.54 Å	1.35 Å	1.10 Å
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**Dipole moment and bond length**

### Example



$\text{H}_2\text{C}-\text{CH}_3$  is a nonpolar bond.

$\text{H}_2\text{C}=\text{CH}_2$  is a polar bond.

$\text{CH}_3\text{CH}_2\text{CH}_3$  is a polar bond.

$\text{CH}_3\text{CH}_2\text{CH}_3$  is a nonpolar bond.

$\text{CH}_3\text{CH}_2\$

# Organic Chem Study Guide

**Paula Yurkanis Bruice**

## Organic Chem Study Guide:

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