

# 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: 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.



### Single (σ) and pi (π) bonds

- Covalent bonds are classified as single (σ) and pi (π).
- Single bonds are formed by head-on overlap of orbitals.
- π bonds are formed by side-on overlap of orbitals.
- Very simple bond is a covalent bond.
- Non-bonding bond consists of one sigma and two pi bonds.



π bond is stronger than σ bond.

## Polar and Nonpolar Covalent Bonds

Depending on the difference in the electronegativity values, covalent bonds can be 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 (like a C-C and C-H bond).
- If the difference in electronegativity is between 0.5 and 1.7, the more polar covalent bond (nonpolar covalent bond electrons are shared in a region of N, O, F and other halogens).
- A difference of 1.7 or higher one of both the atoms can have a larger share and a polar bond is formed.

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

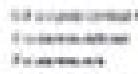


### Reactions and Mechanisms

## Bond Types, Strength, Length, Polarity and Dipole Moment

### Dipole Moment

The polarity of a bond is denoted by the dipole moment ( $\mu$ ).



Direction may be indicated by arrows on the vector sum.

- The dipole moment is shown as a vector pointing from the less electronegative toward the more electronegative atom.
- The vector dipole moment is the partial negative charge and the partial positive charge.
- The dipole plot indicates the charge difference.
- The dipole moment indicates the charge distribution.

### 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 individual bond dipole moments. If dipole moments are canceled, it just means a neutral dipole.



Sum of vector of the bond dipole moment for the molecule.

## Bond Length and Bond Strength

### Reactions of bond length



Bond length:  $\text{C}=\text{O} = 1.21 \text{ \AA}$ ,  $\text{C}=\text{N} = 1.37 \text{ \AA}$ ,  $\text{C}=\text{C} = 1.33 \text{ \AA}$ .

Strength:  $\text{C}=\text{O} = 110 \text{ kJ/mol}$ ,  $\text{C}=\text{N} = 107 \text{ kJ/mol}$ ,  $\text{C}=\text{C} = 105 \text{ kJ/mol}$ .

Nonpolar bond has longer bond length and stronger bond.



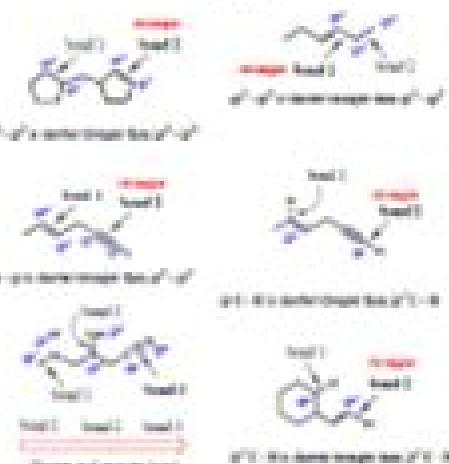
### Reactions of bond strength

## Average values of C-C and C=O bond depending on the nucleophile

C-C Bond	$\text{N}_3^+ - \text{C}_2\text{H}_5$	$\text{N}_3^+ - \text{C}_2\text{H}_5\text{O}$	$\text{N}_3^+ - \text{C}_2\text{H}_5\text{O}_2$
Hybridization	$\text{sp}^2$ (sp <sup>2</sup> )	$\text{sp}^2$ (sp <sup>2</sup> )	$\text{sp}^3$ (sp <sup>3</sup> )
Length	1.37 Å	1.33 Å	1.33 Å
Strength	110 kJ/mol	111 kJ/mol	105 kJ/mol
Hybridization	$\text{sp}^2$	$\text{sp}^2$	$\text{sp}^3$ (sp <sup>3</sup> )
Strength	110 kJ/mol	107 kJ/mol	105 kJ/mol
Length	1.33 Å	1.33 Å	1.33 Å
Strength	110 kJ/mol	107 kJ/mol	105 kJ/mol

### Higher the bond length and stronger bond

## Example



# Organic Chem Study Guide

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**Organic Chemistry** T. W. Graham Solomons,Craig B. Fryhle,Scott A. Snyder,2016 **Study Guide and Solutions Book** Harold Hart,Robert D. Schuetz,1978-01-01 Organic Chemistry Study Guide Robert J. Ouellette,J. David Rawn,2014-10-13 Organic Chemistry Study Guide Key Concepts Problems and Solutions features hundreds of problems from the companion book Organic Chemistry and includes solutions for every problem Key concept summaries reinforce critical material from the primary book and enhance mastery of this complex subject Organic chemistry is a constantly evolving field that has great relevance for all scientists not just chemists For chemical engineers understanding the properties of organic molecules and how reactions occur is critically important to understanding the processes in an industrial plant For biologists and health professionals it is essential because nearly all of biochemistry springs from organic chemistry Additionally all scientists can benefit from improved critical thinking and problem solving skills that are developed from the study of organic chemistry Organic chemistry like any skill is best learned by doing It is difficult to learn by rote memorization and true understanding comes only from concentrated reading and working as many problems as possible In fact problem sets are the best way to ensure that concepts are not only well understood but can also be applied to real world problems in the work place

**Study Guide and Solutions Manual for Essential Organic Chemistry** Paula Yurkanis Bruice,2015-03-04 This Study Guide Solution Manual contains learning objectives chapter summaries and outlines as well as examples self tests and concept questions as well as complete step by step solutions to selected problems **Organic Chemistry, 12e Binder**

**Ready Version Study Guide & Student Solutions Manual** T. W. Graham Solomons,Craig B. Fryhle,Scott A. Snyder,2016-04-11 This is the Student Study Guide Solutions Manual to accompany Organic Chemistry 12th Edition The 12th edition of Organic Chemistry continues Solomons Fryhle Snyder's tradition of excellence in teaching and preparing students for success in the organic classroom and beyond A central theme of the authors approach to organic chemistry is to emphasize the relationship between structure and reactivity To accomplish this the content is organized in a way that combines the most useful features of a functional group approach with one largely based on reaction mechanisms The authors philosophy is to emphasize mechanisms and their common aspects as often as possible and at the same time use the unifying features of functional groups as the basis for most chapters The structural aspects of the authors approach show students what organic chemistry is Mechanistic aspects of their approach show students how it works And wherever an opportunity arises the authors show students what it does in living systems and the physical world around us ORGANIC CHEMISTRY STUDY GUIDE Marc Loudon, Organic Chemistry, Study Guide and Solutions Manual T. W. Graham Solomons,Craig B. Fryhle,2000 On the cover of this book is a Pacific yew tree found in the ancient forests of the Pacific Northwest The bark of the Pacific yew tree produces Taxol found to be a highly effective drug against ovarian and breast cancer Taxol blocks mitosis during eukaryotic cell division The supply of Taxol from the Pacific yew tree is vanishingly small

however A single 100 year old tree provides only about one dose of the drug roughly 300 mg For this reason as well as the spectacular molecular architecture of Taxol synthetic organic chemists fiercely undertook efforts to synthesize it Five total syntheses of Taxol have thus far been reported Now a combination of isolation of a related metabolite from European yew needles and synthesis of Taxol from that intermediate supply the clinical demand This case clearly demonstrates the importance of synthesis and the use of organic chemistry It's just one of the many examples used in the text that will spark the interest of students and get them involved in the study of organic chemistry

**A Self-study Guide to the Principles of Organic Chemistry** Jiben Roy, 2013 A Self Study Guide to the Principles of Organic Chemistry Key Concepts Reaction Mechanisms and Practice Questions for the Beginner will help students new to organic chemistry grasp the key concepts of the subject quickly and easily as well as build a strong foundation for future study Starting with the definition of atom the author explains molecules electronic configuration bonding hydrocarbons polar reaction mechanisms stereochemistry reaction varieties organic spectroscopy aromaticity and aromatic reactions biomolecules organic polymers and a synthetic approach to organic compounds The over one hundred diagrams and charts contained in this volume will help students visualize the structures and bonds as they read the text and make the logic of organic chemistry clear and easily understood Each chapter ends with a list of frequently asked questions and answers followed by additional practice problems Answers are included in the Appendix

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web oct 4 2022 1 in rebar drawings each bar carries its own unique mark number so in this case mk605 is a 6 bar and likely was the 5th 6 the drafter drew an mk402 would be a 4 bar the 2nd one the drafter drew on the page are there other abbreviations here s a listing of abbreviations you may see here s an example

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web lift units of reinforcing bars tied together for shop or field convenience lifts are classified in two categories 1 shop lifts and 2 field lifts shop lifts are units of reinforcing bars loaded for shipment to the jobsite field lifts are units of reinforcing bars required for field handling by the contractor

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web aug 20 2022 abbreviations c c center to center s s l structural slab level f f l floor finish level g l gate level nts no to scale specs specification u n o unless noted otherwise e j expansion joint sche schedule t o c top of concrete rft renf reinforcement typ typical thk thickness 2 general structural notes sheet

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web sep 30 2014 dhenger acronyms are not the issue here and no need to extrapolate my use of ca in the thread to my drawings i do not use abbreviations on my drawings unless they are defined on the drawings my specs specifically require rebar shop drawings to indicate bar cover among all else

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