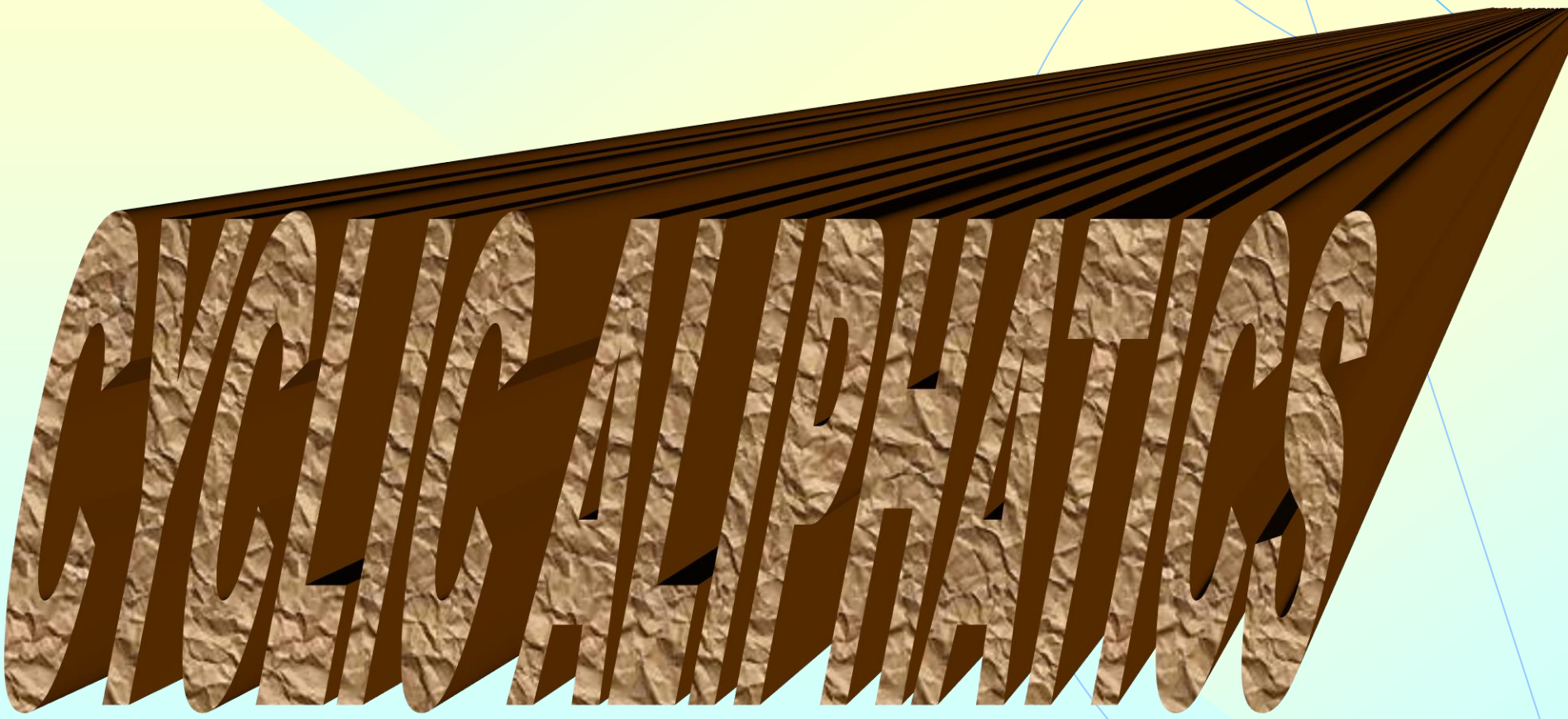
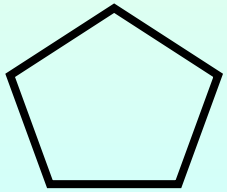

SYSTEMATICS

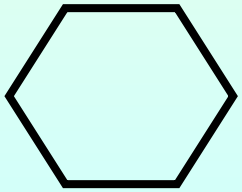
Carbon atoms arranged in such a way as to form ring structures

Nomenclature

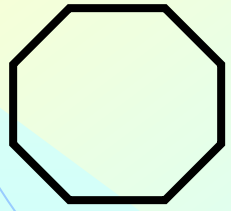
- **Named by prefixing cyclo- to the corresponding open-chain hydrocarbon.**
- **Monocyclic aliphatic rings**



cyclopentane

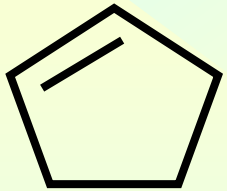


cyclohexane

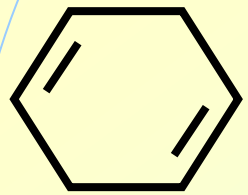


cyclooctane

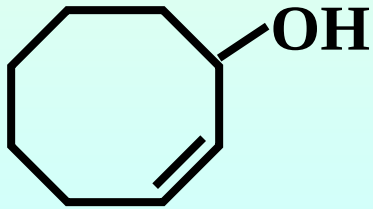
Nomenclature



cyclopentene



1,4-cyclohexadiene

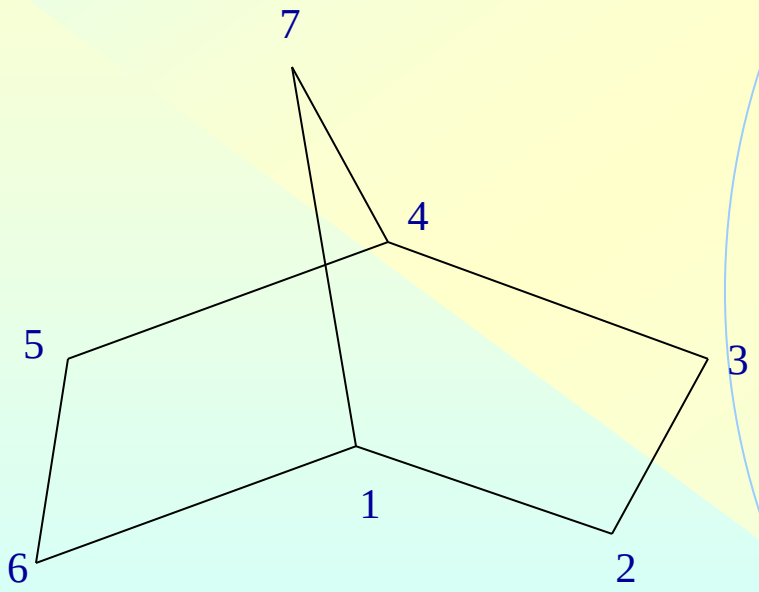


2-cyclooctenol

Nomenclature

- **Polycyclic aliphatic rings**
  - **Locate bridge-head carbons**
  - **Determine the lowest number of rings**
    - mentally break bonds until no rings remain
  - **Indicate carbon number in the longest bridge, then the next longest bridge, etc., until all carbon atoms are utilized**
  - **Began numbering at a bridge-head carbon of the longest bridge**

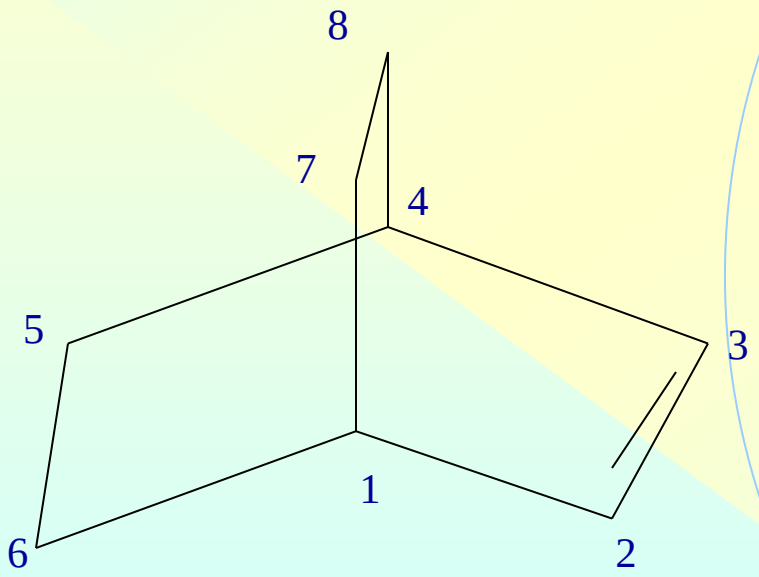
Nomenclature



Bicyclo[2.2.1]heptane

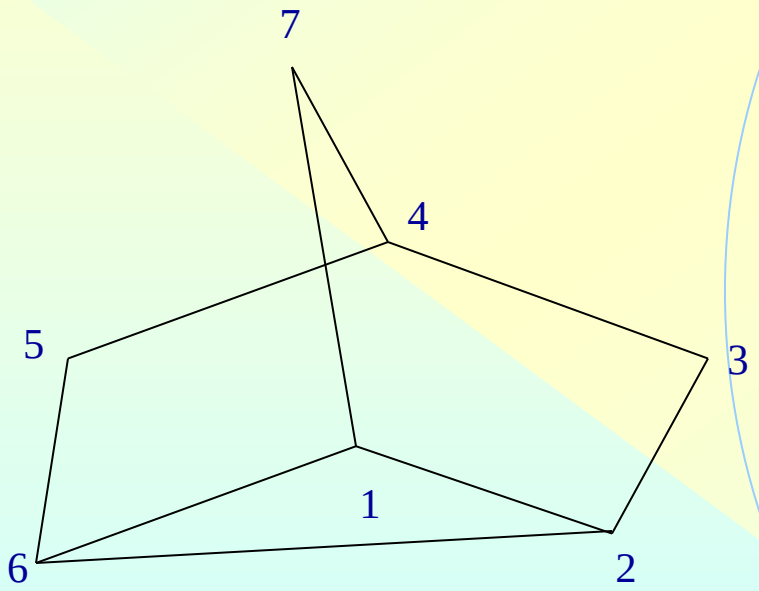
Norbornane

Nomenclature



Bicyclo[2.2.2]octa-2-ene

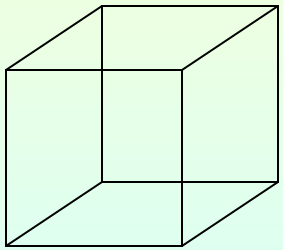
Nomenclature



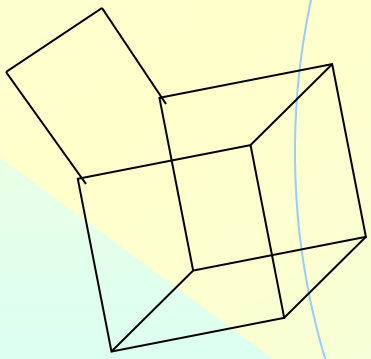
Tricyclo[2.2.1.$0^{2,6}$]heptane

Nortricyclene

Nomenclature

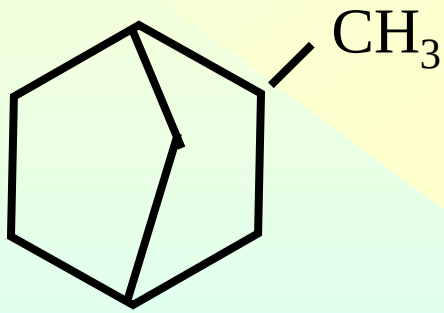


Cubane



Basketane

Nomenclature



2-methylbicyclo[2.2.1]heptane

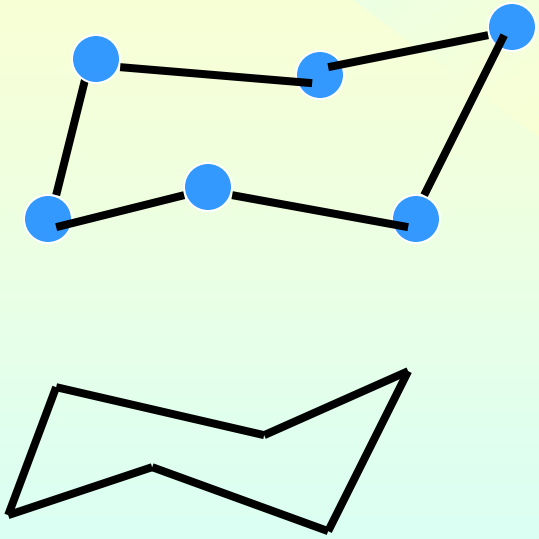
Baeyer Strain Theory

- Adolf von Baeyer -- 1885
- Carbon to four other atoms with a bond angle of 109.5^{o}
- As the bond angle becomes more compressed, increasing strain is placed on the molecule
- As strain increases, bond stability decreases

Factors Affecting Stability

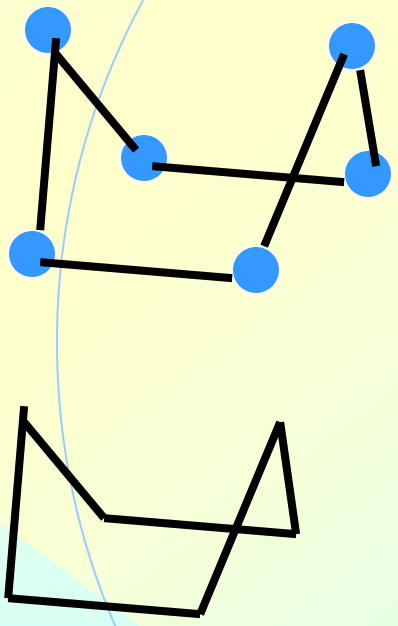
- **Angle strain**
- **Torsional strain**
- **van der Waals strain (steric strain)**

Conformations of cycloalkanes



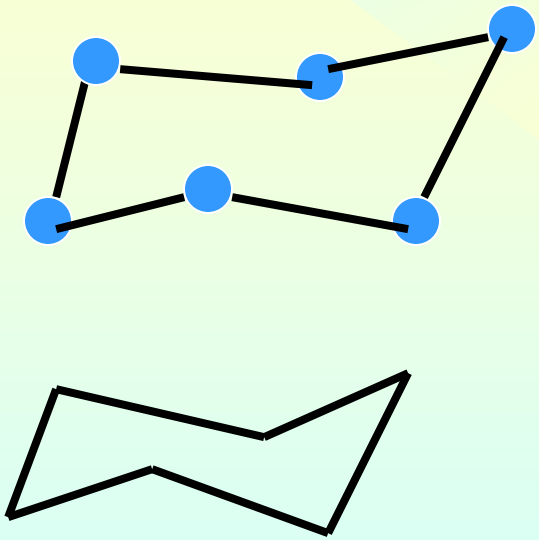
Chair conformation

Conformations of cycloalkanes

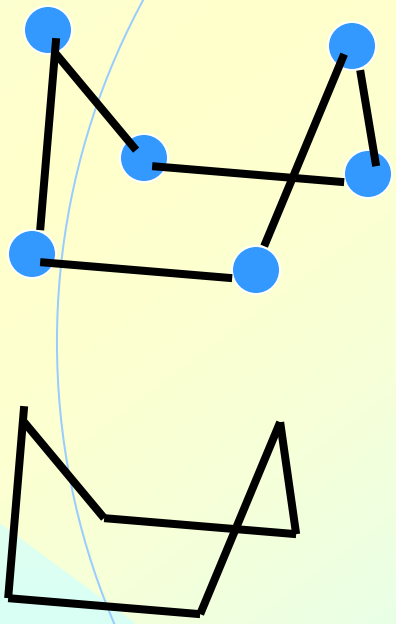


Boat conformation

Conformations of cycloalkanes

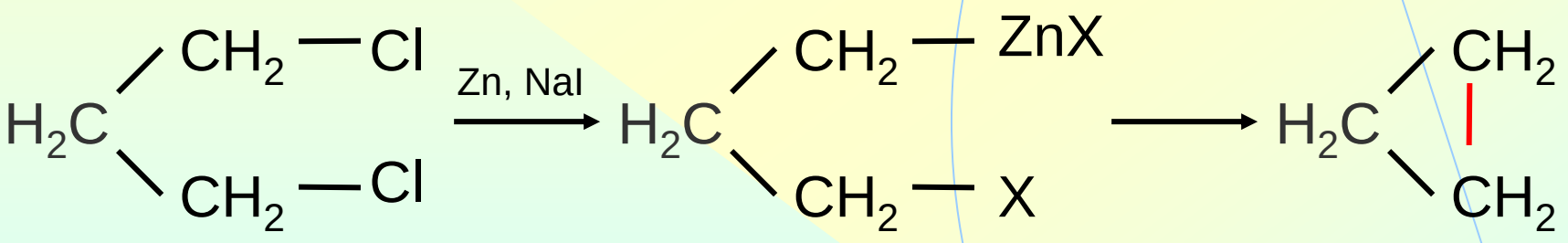


Chair conformation



Boat conformation

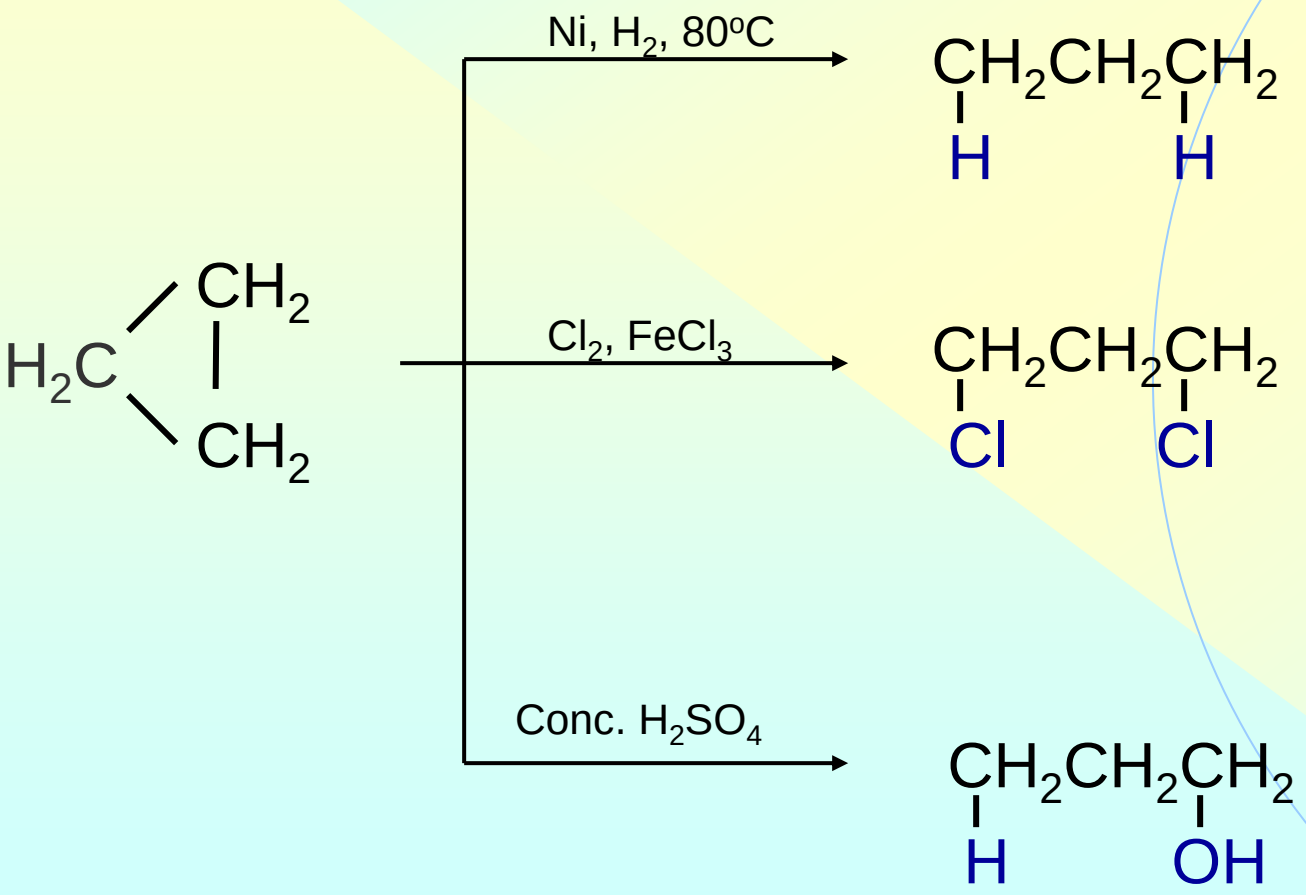
Preparation



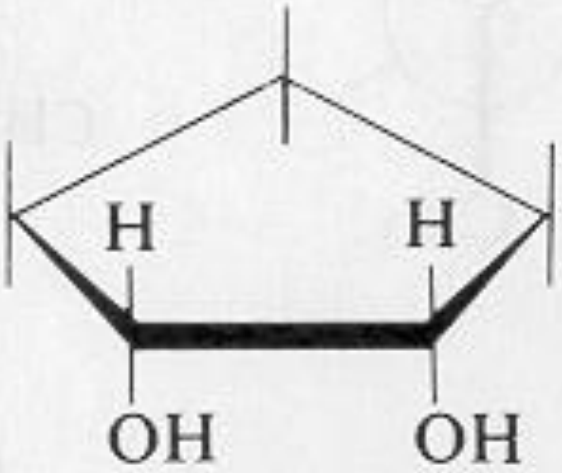
1,3-Dichloropropane

Cyclopropane

Reactions of Small Rings

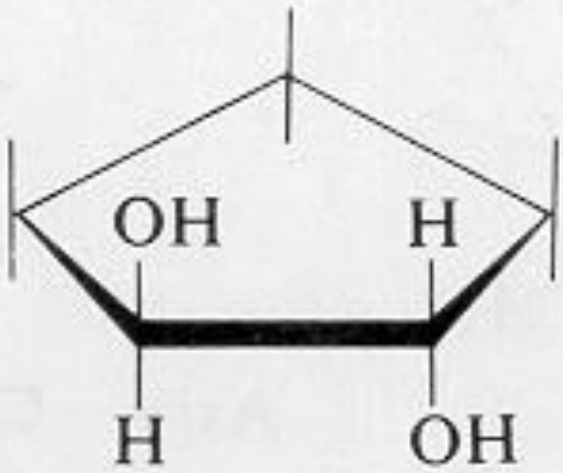


Stereoisomerism of Cyclic Compounds



I

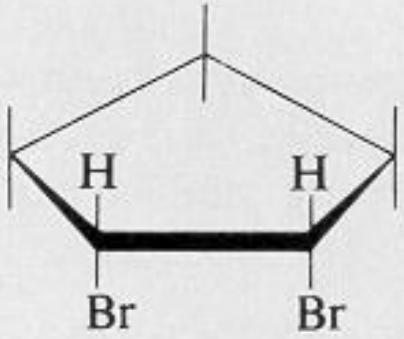
cis-1,2-Cyclopentanediol



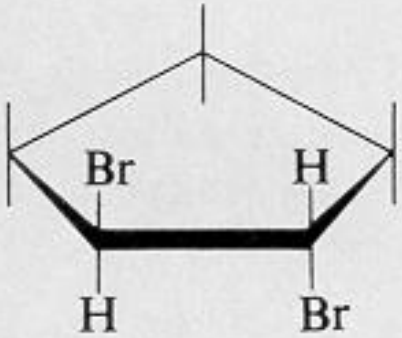
II

trans-1,2-Cyclopentanediol

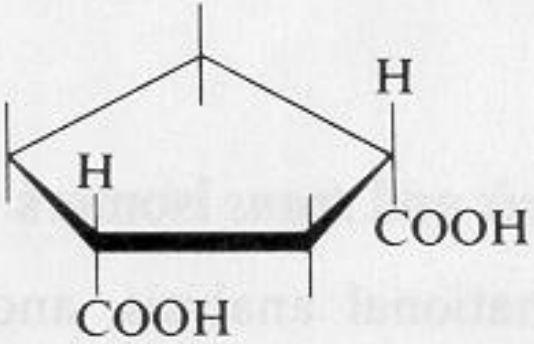
Stereoisomerism of Cyclic Compounds



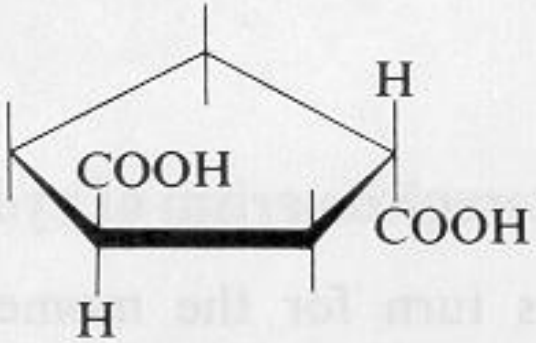
cis-1,2-Dibromocyclopentane



trans-1,2-Dibromocyclopentane

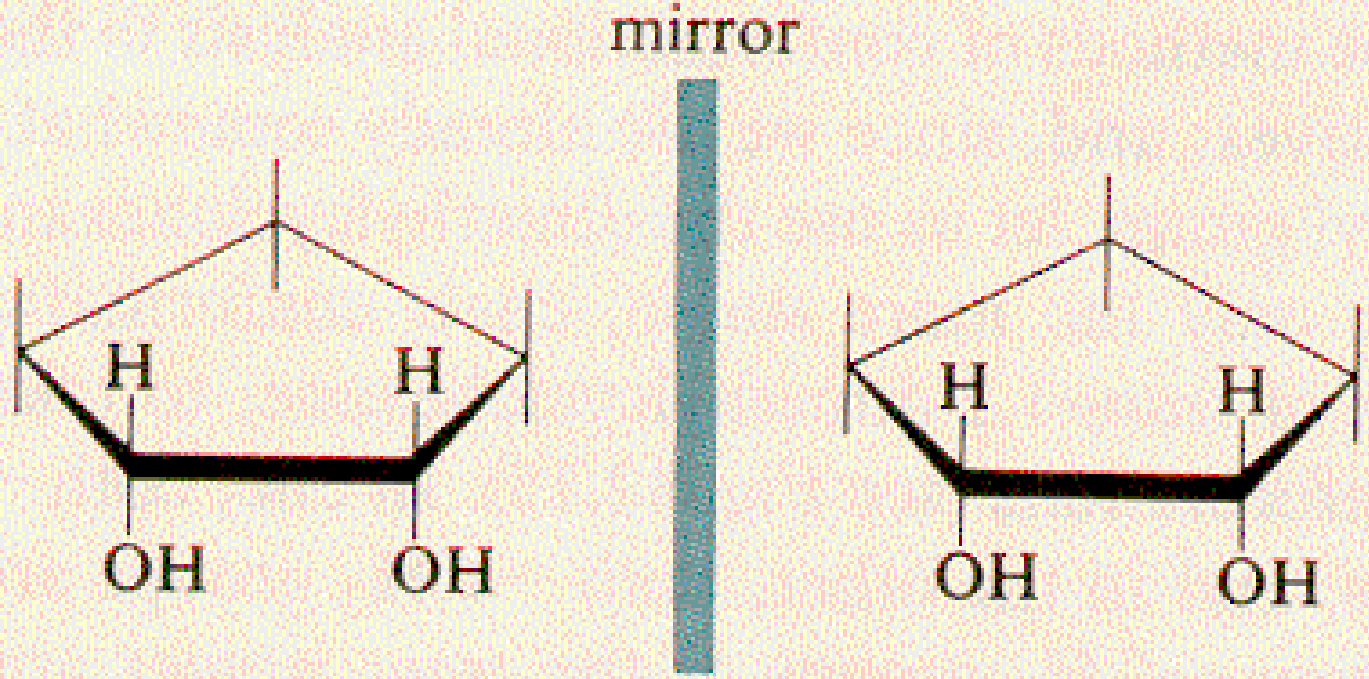


cis-1,3-Cyclopentanedicarboxylic acid



trans-1,3-Cyclopentanedicarboxylic acid

Stereoisomerism of Cyclic Compounds

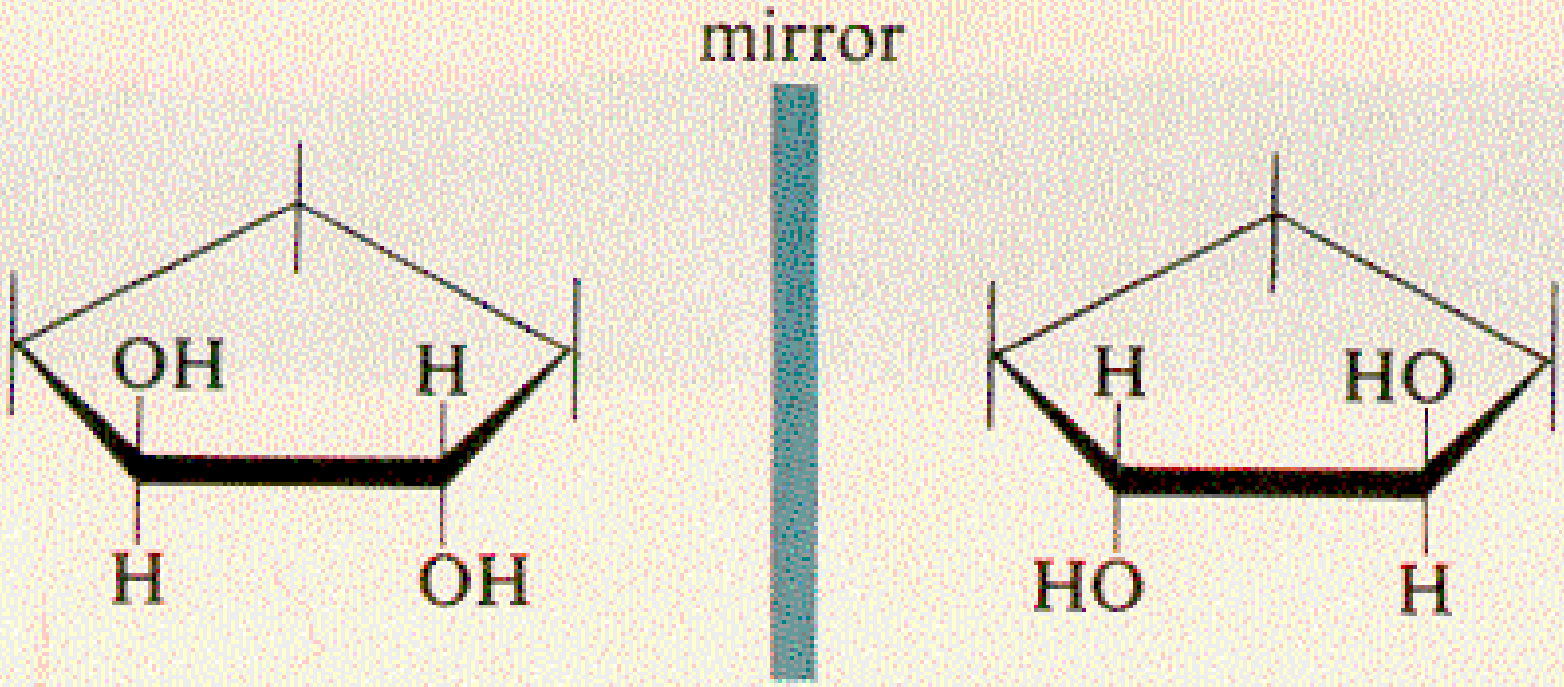


Superimposable

A meso compound

cis-1,2-Cyclopentanediol

Stereoisomerism of Cyclic Compounds

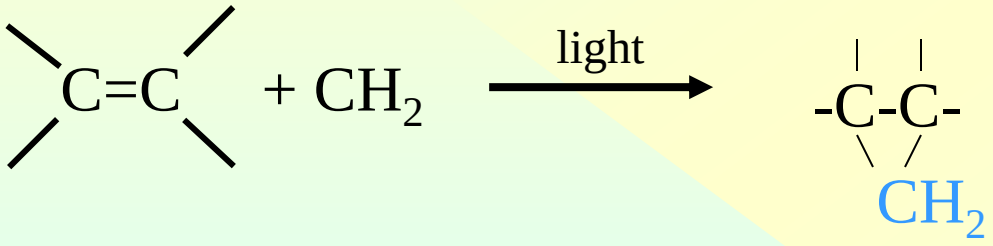


Not superimposable

Enantiomers: resolvable

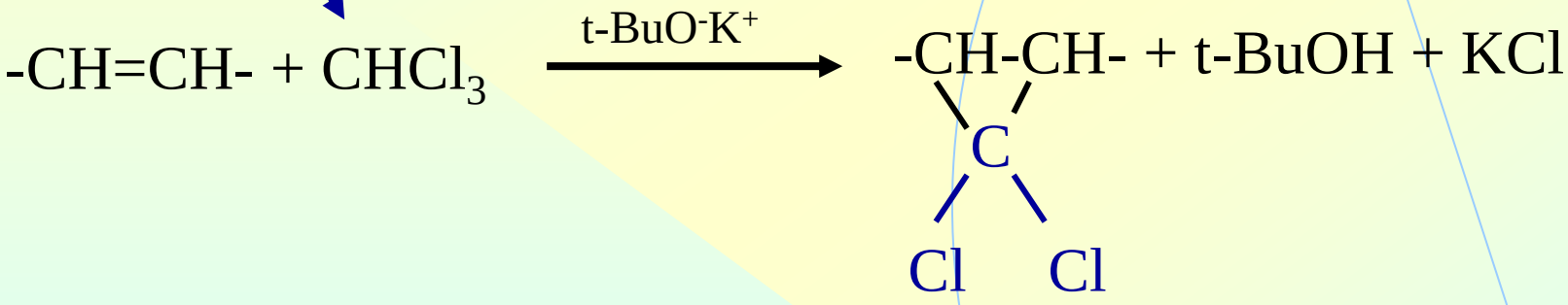
trans-1,2-Cyclopentanediol

Carbenes-cycloaddition

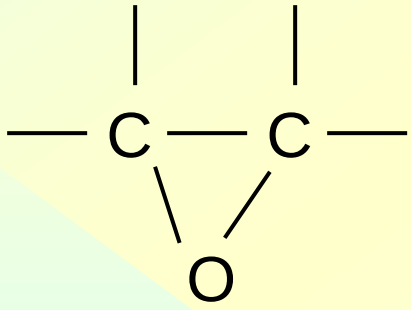


Addition of Substituted Carbenes

Chloroform



Epoxides

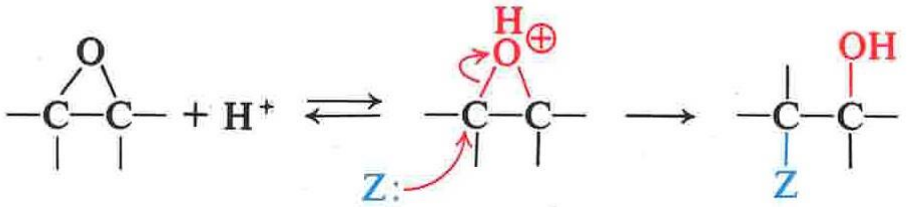


Epoxide ring

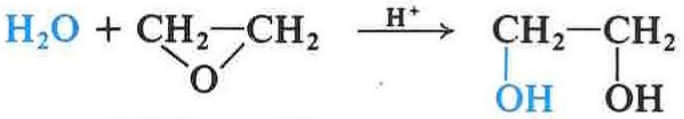
(Oxirane ring)

REACTIONS OF EPOXIDES

1. Acid-catalyzed cleavage. Discussed in Sec. 13.22.

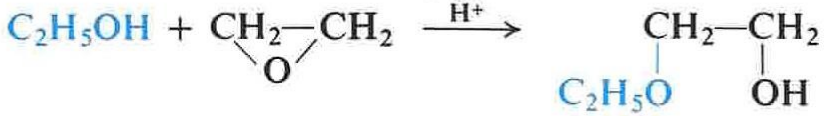


Examples:

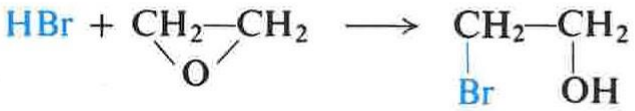


Ethylene oxide

1,2-Ethanediol

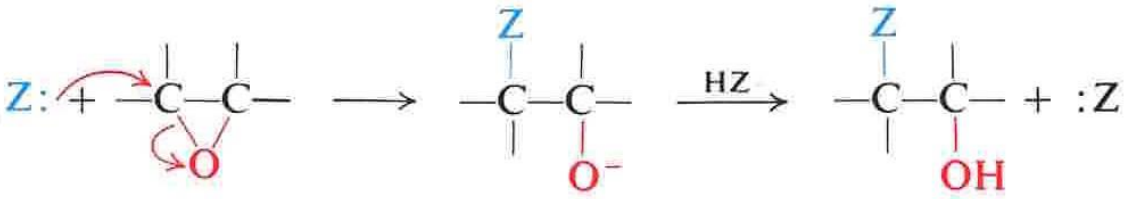


2-Ethoxyethanol



Ethylene bromohydrin
(2-Bromoethanol)

2. Base-catalyzed cleavage. Discussed in Sec. 13.23.



Examples:

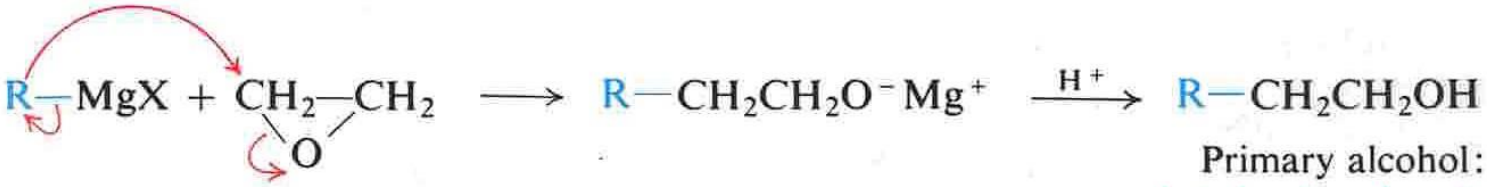
$C_2H_5O^-Na^+ + CH_2—CH_2$ (O) $\longrightarrow C_2H_5O—CH_2CH_2OH$

Sodium ethoxide — 2-Ethoxyethanol

$NH_3 + CH_2—CH_2$ (O) $\longrightarrow H_2N—CH_2CH_2OH$

2-Aminoethanol (Ethanolamine)

3. Reaction with Grignard reagents. Discussed in Sec. 18.15.



Primary alcohol: *chain has been lengthened by two carbons*

Acid-catalyzed cleavage of eposides

vs

Acid-catalyzed cleavage of eposides

Analysis of alicyclic compounds