CHEM 20481 - Basic Organic Chemistry - Chapter 7 Review
Stereochemistry

1 Definitions

Stereogenic (Chiral) center: A carbon atom connected to four different groups. All atoms in a group must be considered, not just that atoms directed bound to the chiral carbon.

AChiral molecule: A molecule that does <u>not</u> contain a stereogenic center.

Chiral molecule: A molecule that <u>does</u> contain a stereogenic center.

Stereoisomers: Molecules that differ *only* in their 3-dimensional structure.

- **Enantiomers:** Mirror-image isomers. Typically requires at least one stereogenic center. Enantiomers have identical physical and chemical properties.
- **Diastereomers:** Non "mirror-image" isomers. Generally requires two or more stereogenic centers. Diastereomers have different physical and chemical properties.
- **Meso:** A molecule containing two (or more) chiral centers in which the mirror image of the molecule is identical. Requires that the molecule contain an internal mirror plane. In practice, only possible if the molecule can be 'numbered' from either end. (For example, 2,3-dibromobutane).

Absolute Configuration: A description of the stereochemistry of a single atom in a molecule. Typically denoted as "R" or "S".

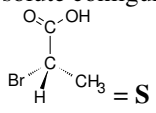
Optically Pure: All of the molecules in a sample have identical stereochemistry.

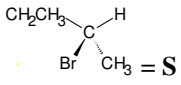
Racemic Mixture: Molecules in a sample have different stereochemistry.

Optical Purity: (Percent of one enantiomer) - (Percent of other enantiomer)

2 Absolute Configurations

Be able to assign absolute configurations to all chiral centers in a molecule using the Cahn-Ingold-Prelog priority rules.

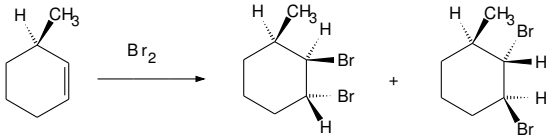
Ex.  = **S**

 = **S**

3 Reactions

1. If the chiral atom of a molecule does not react in a chemical reaction, the stereochemistry around that atom will not change.
2. If a chemical reaction creates a new chiral center from an achiral center, the product will be a racemic mixture.

   Ex. $CH_3CH_2CH{=}CH_2 \xrightarrow{HBr} CH_3CH_2CH(Br)CH_3$ Carbon #2 is a chiral center, and will be 50% "R", 50% "S".

   Chirality of the 'top' carbon (containing methyl group) doesn't change. Two new chiral centers form (carbons attached to bromine atoms), and product will be an equal mixture of two forms. Note that Br_2 undergoes an <u>anti</u>-addition, so the relationship between these two atoms will be *trans*.
3. It is possible to 'lose' chiral centers in a reaction.

   Ex. $CH_3CH_2CH(Br)CH{=}CH_2 \xrightarrow[Pd]{H_2} CH_3CH_2CH(Br)CH_2CH_3$