

4: Stereochemistry

Preview

4.1 Tetrahedral Carbon Configurations

Two Configurations at Tetrahedral Carbon (4.1A)

Non-Superimposable Mirror Images

Handedness and Chirality

Chiral Atoms (4.1B)

Chiral Carbon Atoms

Other Chiral Atoms

Molecular Chirality

4.2 Stereoisomers and R,S Assignments

R and S Nomenclature (4.2A)

Clockwise and Counterclockwise Isomers

The Assignments of R and S

R and S Assignment Rules (4.2B)

Case 1. Each Atom Directly Bonded to a Chiral C are Different

Case 2. Two or More Atoms Bonded to a Chiral C are the Same

Case 3. Groups with Double and Triple Bonds

More Complex Molecules

4.3 The Number and Types of Stereoisomers

Compounds Can Have 2^n Stereoisomers (4.3A)

2-Bromo-3-chlorobutane

Configuration at C2 in the (2R,3R) Isomer

Configuration at C2 in the other Stereoisomers

Relationships Between Stereoisomers (4.3B)

Enantiomers

Diastereomers

Compounds with Fewer than 2^n Stereoisomers (4.3C)

2,3-Dibromobutane

Meso Form

4.4 Drawing Structures of Stereoisomers

3-D Conformations of Stereoisomers (4.4A)

Many Ways to Draw the Same Stereoisomer

3-D Structures for Comparing Stereoisomers

Fischer Projections (4.4B)

Definition of Fischer Projections

Manipulations of Fischer Projections

Using Fischer Projections to Draw Stereoisomers

4.5 Cyclic Molecules

Cyclic Stereoisomers (4.5A)

Chiral Centers in 1-Bromo-3-methylcyclohexane

Stereoisomers of 1-Bromo-3-methylcyclohexane

Stereochemical Relationships between cis and trans Isomers

Isomeric Bromomethylcyclohexanes

(continued)

Drawings of Cyclic Stereoisomers (4.5B)

Wedge-Bond Structures

Chair Forms

Haworth Projections

4.6 Optical Activity

Rotation of Plane Polarized Light and the Polarimeter (4.6A)

Polarimeter

Light Rotation by the Sample

Magnitude and Sign of Light Rotation (4.6B)

Observed versus Specific Rotation

Specific Rotations of Enantiomers

Relative and Absolute Configurations

Specific Rotations of Diastereomers

d and l Isomers

Racemic Mixture

Appendix A: Resolution of Stereoisomers

Resolution of Diastereomers

Resolution of Enantiomers

Appendix B: Optical Purity

%Optical Purity

Enantiomeric Excess (%ee)

Appendix C: Absolute Configuration

Chapter Review

Feature: What a Difference a Configuration Makes