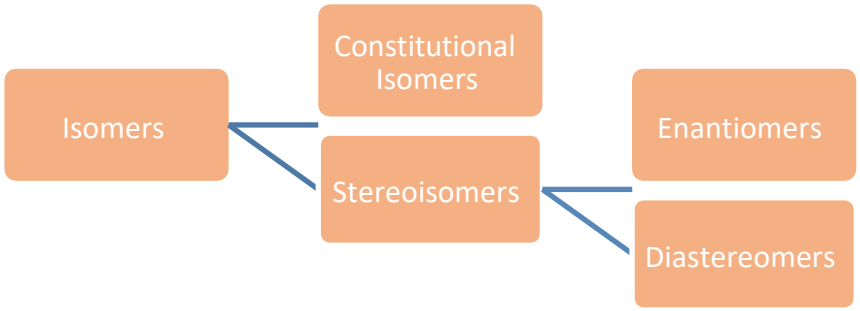
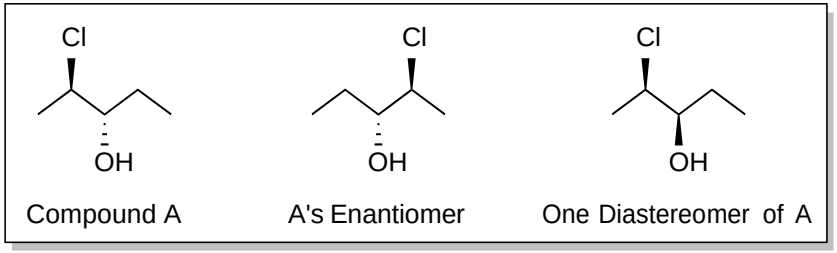
STEREOISOMERISM

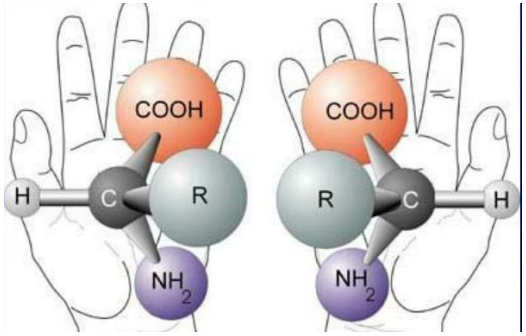


- Isomers – Different compounds with the same molecular formula.
- Constitutional Isomers – Compounds with the same molecular formula but different atom connectivity.
- Stereoisomers – Compounds with the same atom connectivity but a different orientation of the atoms in space.
- Enantiomers – Stereoisomers that are non-superimposable mirror images
- Diastereomers – Stereoisomers that are non-superimposable and are not mirror images.



➢ Chirality

✓ A molecule will be achiral if it has a plane or symmetry or a center of symmetry. If a molecule is achiral, it can be superimposed on its mirror image and thus does not have an enantiomer.

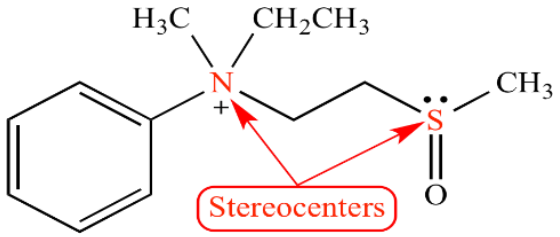


Chiral molecule

✓ A compound is **chiral** if it cannot be superimposed on its mirror image. A chiral compound will have two enantiomeric forms.

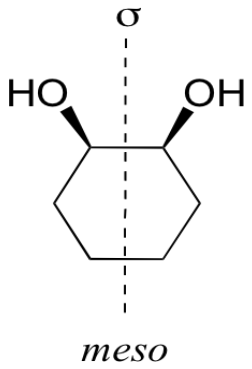
➢ Stereocenter

✓ An atom about which an exchange of two groups produces a stereoisomer.



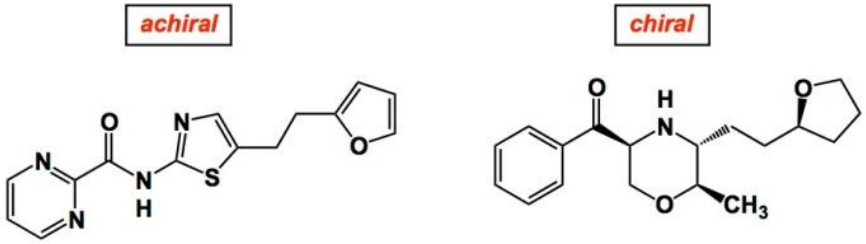
Meso-compound

A compound that contains two or more asymmetric centers, but is achiral due toa plane of symmetry.



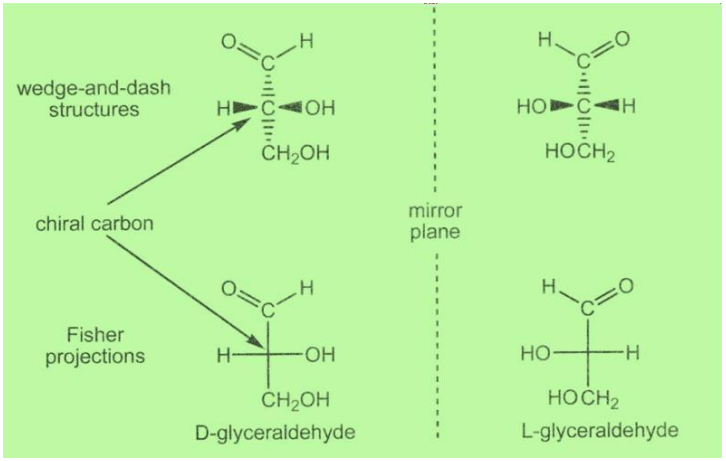
➢ Drawing Chiral Molecules

- ✓ It should be noted that that there are several different, yet correct, ways to represent the 3D structure of a chiral molecule.
- ✓ Below are five different representations of one enantiomer of2-chloro-butane. Convince yourself that these are all the same molecule.
- ✓ Representation (A) simply shows the stereochemistry of the chlorine. Since the two carbon bonds are in the plane and –Cl isout, you can assume –H is back. Representation (C) is the same as (A) with the –H drawn in.
- ✓ Representation (B) is just (A) flipped horizontally. Representations (D) and (E) show only the bonds at the chiral center while all others are condensed



➢ Fisher Projections

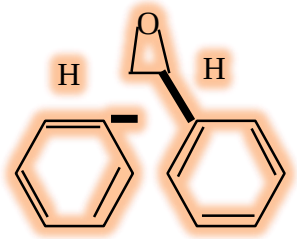
The Fisher projection is a different way to view molecules. Fisher projections are most useful for compounds with multiple chiral centers (such as monosaccharides).In the Fisher projection, groups along the horizontal plane are coming out towards you, while groups in the vertical plane are going back away from you.



➢ Diastereomers

- ✓ Diastereomers are non-enantiomeric isomers arising when more than one stereocenter is present in a molecules Compounds which differ in the absolute configuration at a single stereo-genic center are called Epimers.
- ✓ The process of changing the absolute configuration at one of the stereo genic centers of a diastereomer is called Epimerization**.**

Example of Diastereomers



➢ Optical RotationNomenclature

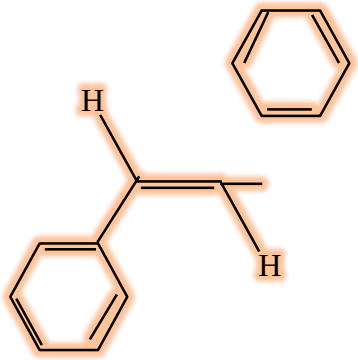
Enantiomers can rotate the plane of polarization of plane polarized light.

- **Dextrorotatory (+)** enantiomer giving a positive optical rotation
- **Levorotatory (-)** enantiomer giving a negative optical rotation

The “dl” nomenclature system previously used to designate the sign of optical rotation is no longer used, **(+)** and **(-)** symbols are now preferred.

➢ Cis-Trans

Cis-Trans Isomers are the simplest stereoisomers. Cis-Trans Isomer-ism in Olefinic Compounds.



Trans isomer
E (Entgegen = “opposite”)

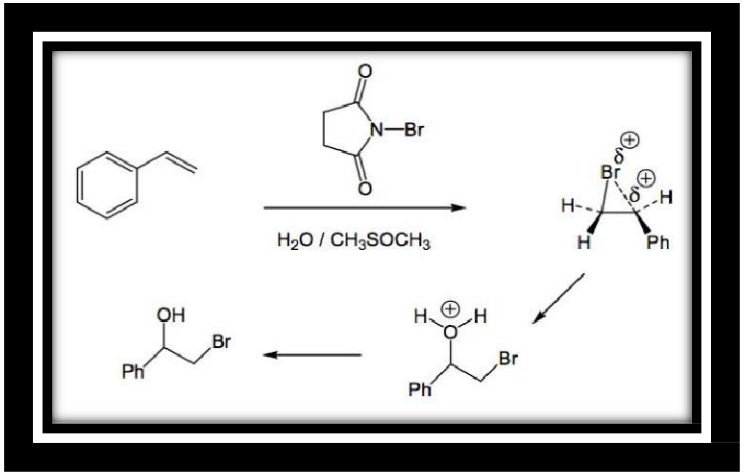
➢ Classical Resolution

- Enantiomers have identical physical properties, and consequently cannot be directly separated by conventional methods such as distillation, crystallization, sizing, or chromatography on conventional station-aryl phases.
- Physical separation of the enantiomers comprising a racemic mixture quires the use of some external enantiopure or enantioenriched material or device.

Classically, enantiomers have been separated by

forming diastereomeric salts or derivatives with enantioenriched chiral pool reagents.

- Since these diastereomeric derivatives are no longer enanti omers, they can be separated by conventional separation methods such as crystallization, or chromatography on silica or other conventional stationary phases.



➢ Naming using the *R/S* Convention

- Name chiral compound as usual with IUPAC nomenclature
- Identify the configuration of the chiral center(s) by placing the configuration of the chiral center(s) in parenthesis before the regular IUPAC name.
- Within the parentheses, list the carbon number at that carbon. If more than one stereocenter is present separate the configurations by a comma.

➢ Reference:

1)Textbook of Organic Chemistry Arjun Bahl & B.S. Bhal.

2) Textbook of Organic Chemistry by PV Publication.

Prepared by: 1) Sanskruti Gadge.

2) Anushka Kurhade.

Guide by: Dr. Chiwadsheeti N.S.

(ASSISTANT PROFESSOR)

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