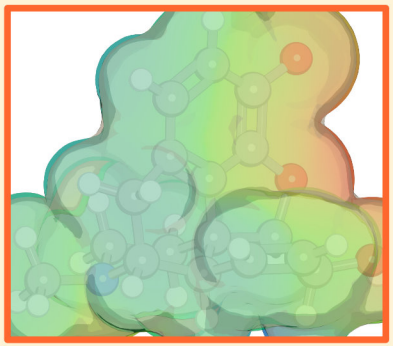
HIGHLIGHTS

- Configuration/conformation
- Stereoisomers
- Stereocentres
- Chiral (& achiral)
- Enantiomers
- Diastereomers



Stereochemistry describes the three-dimensional shape of a molecule, giving a picture of the relative spatial orientation of the constituent atoms. Shape can differ due to the ***configuration*** of an atom (the location of the bonds) or the ***conformation*** of the molecule (rotation around a σ bond). This summary is concerned with ***stereoisomers*** that differ by their configuration. Such isomers have the same constitution and connectivity, the same atoms (molecular formula) bonded to the same atoms but will have a different arrangement in space. Despite being virtually identical, possessing all the same functionality and bonds, stereoisomers can be very different especially in biological systems. *As always, this is a simplification but should be a good enough starting point for most undergraduates.*

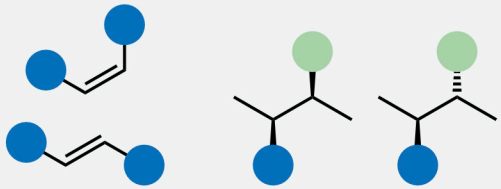
CHEMISTRY CLASSICS

AN INTRODUCTION TO STEREOCHEMISTRY

STEREOCENTRES

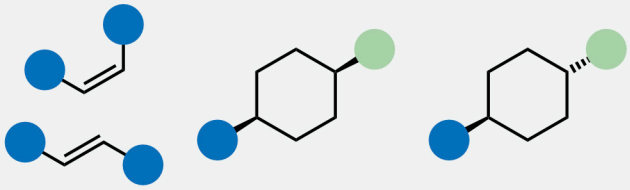
Introduction to stereoisomers

1. Stereoisomers

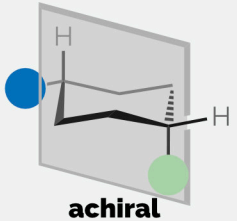


Stereoisomers have the same constitution (atoms and bonds) but a different 3D-arrangement. They are different compounds.

4. Diastereomers (damn it, this looks like it is out of order but only way it would fit. Just follow the numbers ...)



achiral diastereomers
*different **shape** - different relative stereochemistry*
internal separation different

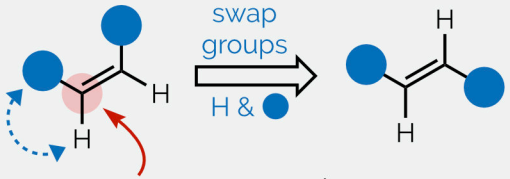


achiral
internal plane of symmetry

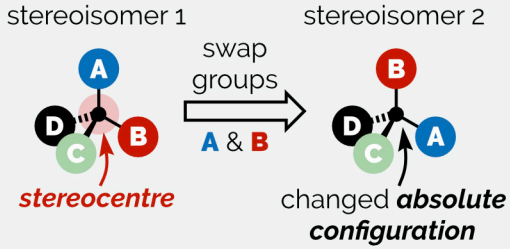
chiral diastereomers
different relative stereochemistry
internal separation different

Diastereomers - stereoisomers with same constitution but are not mirror images. They must have more than one stereocentre & the absolute configuration of at least one stereocentre will remain constant. The ***relative stereochemistry*** or ***relative configuration***, the arrangement of atoms compared to each other, will be ***different***. The *internal separation* of atoms is different.

2. Configuration & Stereocentres



stereocentre - swapping groups leads to stereoisomer



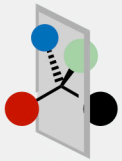
The ***absolute configuration*** of an atom is the spatial arrangement of groups on it.

If changing any ***two*** groups leads to a ***stereoisomer***, the atom is a ***stereocentre***.

3. Chiral & Achiral Molecules

achiral *(same)*
molecule 1 = molecule 2
same 'configuration'

chiral *(different; enantiomers)*
molecule 1 ≠ molecule 2
different absolute configuration

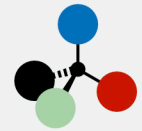


chiral
no internal plane of symmetry

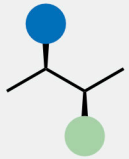
Achiral - molecule is superposable on mirror image (in at least one conformation). The mirror images are the same molecule.

Chiral - molecule ***not*** superposable on mirror image in any conformation. The mirror images are different & are ***enantiomers***. The *internal separation* of atoms is identical.

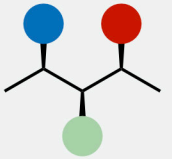
5. Relationships between stereoisomers



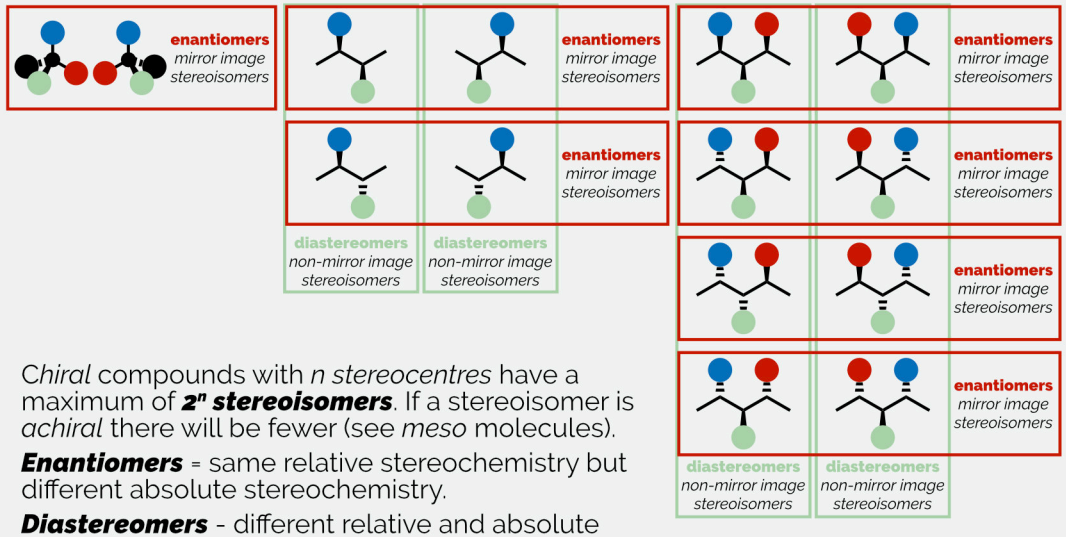
1 stereocentre
2 stereoisomers



2 stereocentres
4 stereoisomers



3 stereocentres
8 stereoisomers



Chiral compounds with *n stereocentres* have a maximum of ***2ⁿ stereoisomers***. If a stereoisomer is *achiral* there will be fewer (see *meso* molecules).

Enantiomers = same relative stereochemistry but different absolute stereochemistry.

Diastereomers - different relative and absolute stereochemistry.