

# Stereochemistry

For  
B.Sc Chemistry(Part-II)  
Organic chemistry  
Paper-III  
Lecture-06



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# Stereochemistry

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## **Contents:**

**Stereoisomerism**

**Projection formula elements of Symmetry**

**Geometrical and optical isomerism**

# Stereochemistry

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**Stereochemistry** - three-dimensional arrangement of atoms (groups) in space.

Stereoisomers: Molecules with the same connectivity but different spatial arrangement of atoms (groups) in space.

**Isomer:**

Isomer have different physical properties like B.P, density

But have chemical properties in most cases

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## Enantiomer

An **enantiomer** is a stereoisomer that is a non-superimposable mirror image of each other.

It describes the comparison between two stereoisomers.

Enantiomers do have **chiral** centers in the molecules

But not all stereoisomers of a molecule are enantiomers of each other.

## Diastereomers

A **diastereomer** is a stereoisomer with two or more stereocenters

The isomers are not mirror images of each other

The compounds which neither show mirror image relationship, nor are superimposable on each other.

Such compounds have same bond connectivity

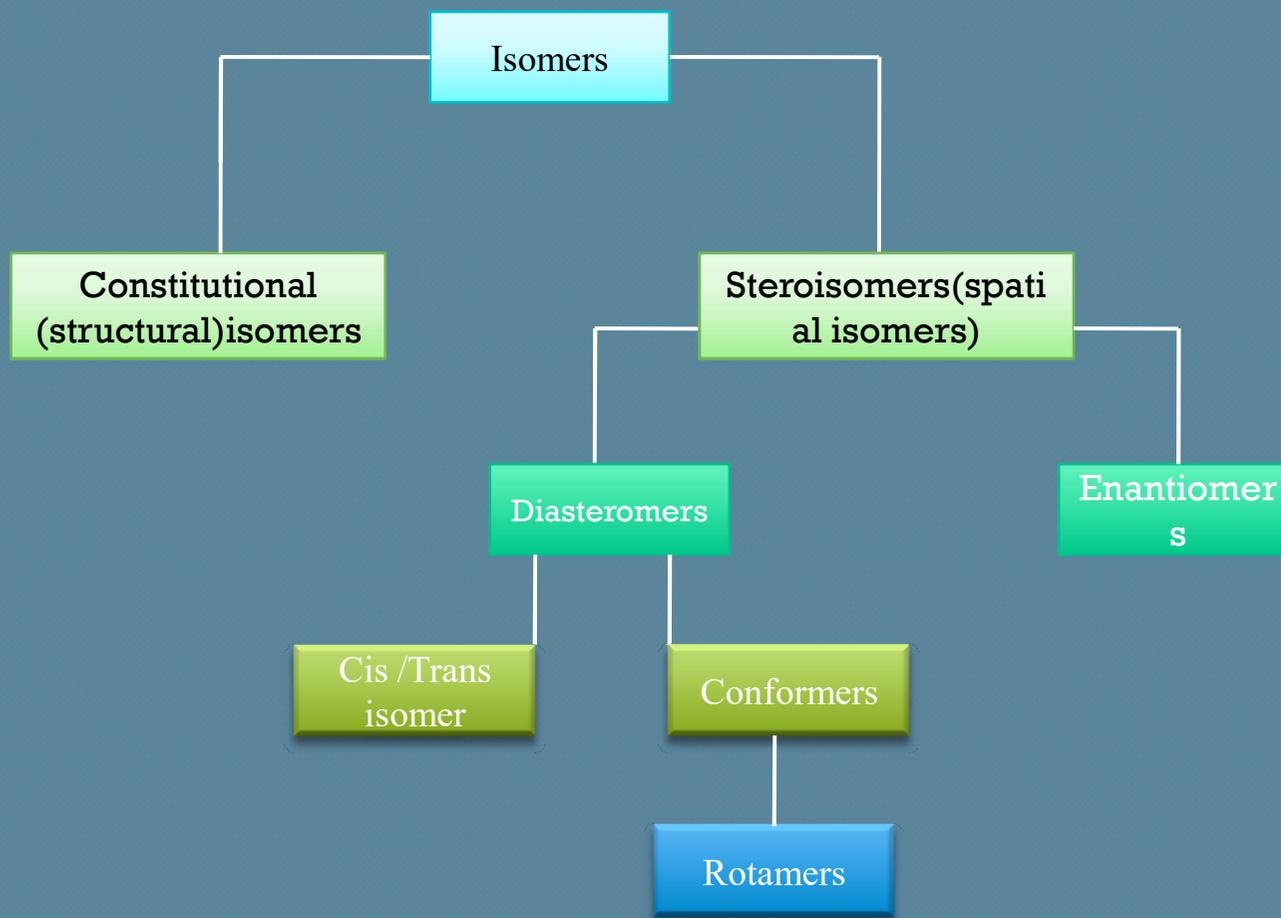
Each of two or more compounds differing only in the spatial arrangement of their atoms

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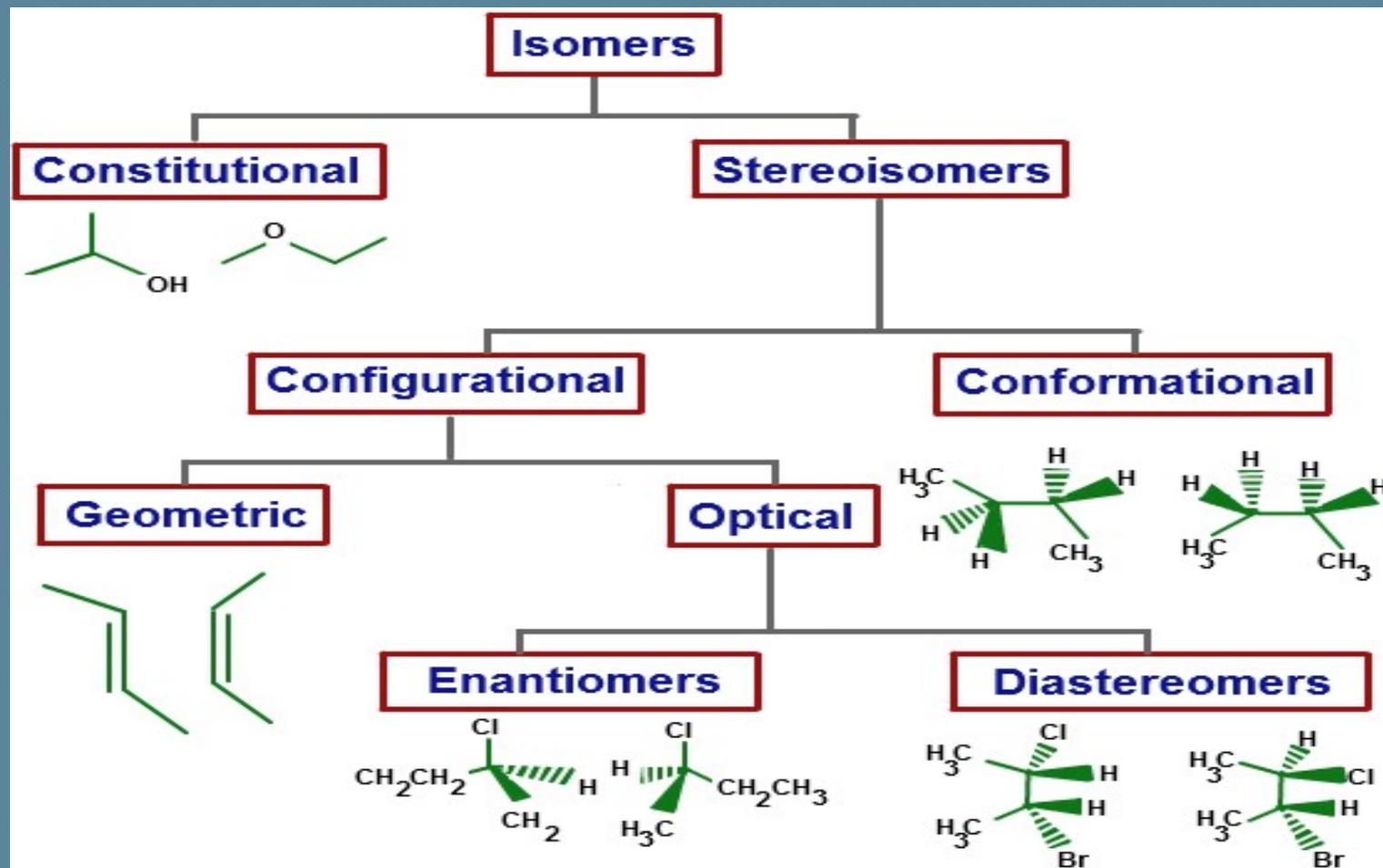
## Two types of stereoisomers

Diastereomerism (including cis-trans isomerism)

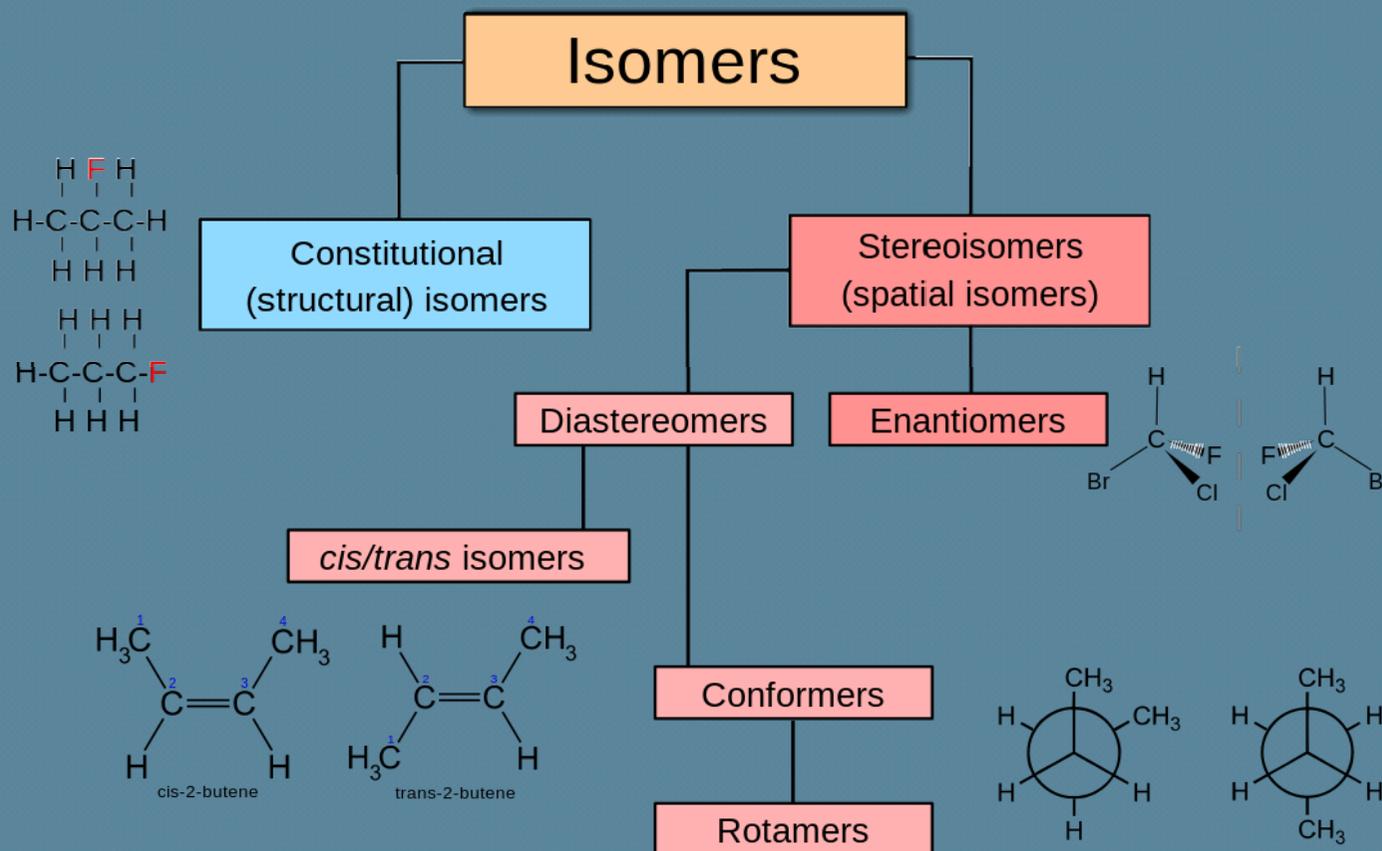
Optical Isomerism (enantiomerism and chirality)



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# Stereochemistry



# Stereochemistry

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**Symmetry element** is a geometrical entity that may include a line, a plane, or a point about which one can perform an **operation** of rotation, reflection, or inversion.

**Symmetry operation** is movement of a molecule or object about an symmetry element due to this the resulting configuration is indistinguishable from the original

**The different symmetry elements that a molecule may possess are:**

1. **E** - the identity.

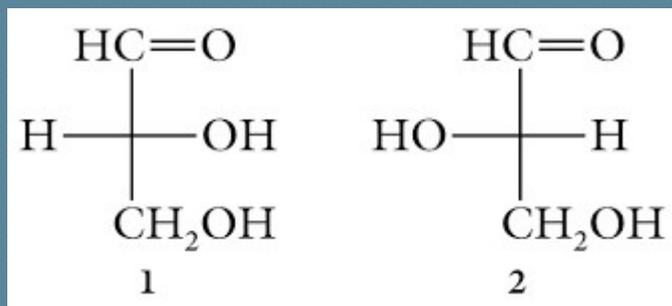
The identity operation consists of doing nothing molecule.

1. **C<sub>n</sub>** - n-fold axis of rotation. Rotation by  $360^\circ/n$  leaves the molecule entirely unchanged on passing imaginary line.

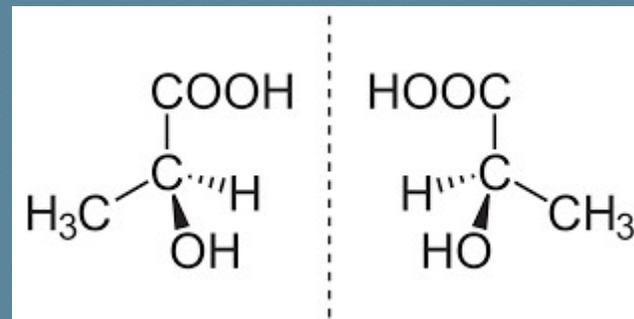
2. **σ** - a plane of symmetry.

3. **i** - a center of symmetry.

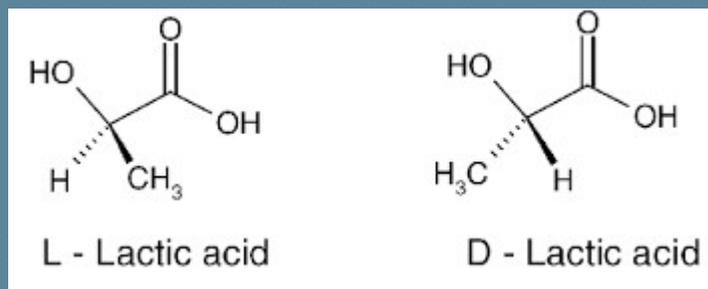
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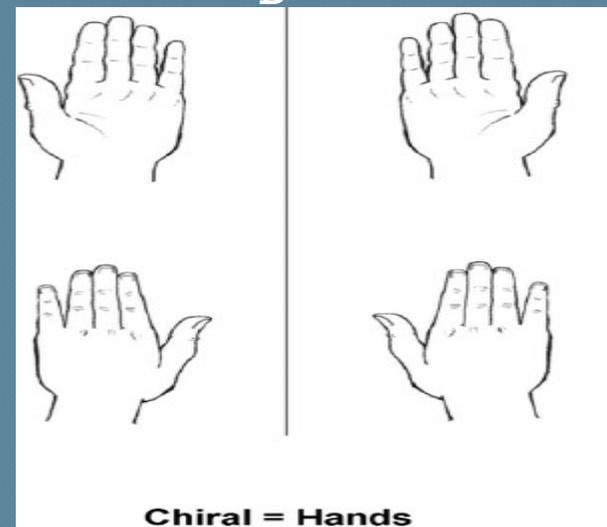
A



B



C



Enantiomer Fig-A,B,C

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## Isomer is due to restricted rotation of C=C bond

1. **Geometric isomers** have the same structural formulas but differ in the arrangement of groups at a single atom or at double bonds.

**Geometrical isomers** are pairs of compounds containing the same substituents attached to a carbon-carbon double bond differently.

2. **Optical isomers** rotates the light in one direction, the other rotates the light in the opposite direction but by the same amount.

**Optical isomers** are pairs of compounds which appear as mirror images of each other

**Optical isomers** are called enantiomer

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1. Questions for practice:
2. Q1. What do you mean by stereoisomers?
3. Q2. What are the types of Stereoisomerism?
4. Q3. Can 2 butene exist as a stereoisomer?
- 5.