$$CH_3$$
 $-CH_2$ $-CH_2$ $-CH_3$

Butane

1. Constitutional (or structural) isomers: Same molecular formula, but different connectivity of atoms.

2. Stereoisomers:

Two general types of isomerism:

Same molecular formula, same connectivity, but different spatial arrangement. Note: This is not just rotation around single bonds! (Conformers)

cis-1,2-Dimethylcyclopropane

trans-1,2-Dimethylcyclopropane

CH₂ Η

Left hand

CH₃-CH-CH₃

CH2

2-Methylpropane

Chirality or Handedness – one hand is the mirror image of the other, but they can be superimposed.

Enantiomers - Are compounds that are nonsuperimposable mirror images of one another.

Enantiomers differ only in the direction in which they rotate the plane-polarized light.

Rotation in the clockwise direction is called dextrorotatory (+) and in the anticlockwise direction, levorotary (-).

To be Enantiomers:

A tetrahedral stereocenter (chiral center) is required:

The molecule needs to have an **sp³ carbon** (tetrahedral) attached to four different substituents.

A Fischer Projections - Is a 2-dimensional representation of a 3-dimensional molecule.

- 1. Places the most oxidized group at the top.
- 2. Uses vertical lines in place of dashes for bonds that go back.
- 3. Uses horizontal lines in place of wedges for bonds that come forward.
- 4. The C chain is drawn vertically.

Nomenclature for enantiomers

Each enantiomer of a pair of enantiomers is specified by adding

a prefix to the name of the compound.

We'll use the D- and L- system (it's simpler and it's used extensively in biochemistry and biology)

Applies only when the tetrahedral stereocenter has

the following substituents:

Hydrogen Heteroatom substituent (X-, OH-, NH₂) Two different R substituents

 \mathbf{Rr} CH, CH

Dash-wedge structures of glyceraldehyde

0 0 HO-C-H -Ċ-OH CH,OH CH,OH

Mirror Extend forward Fischer projections of glyceraldehyde Project bad



Many biological molecules contain more than one tetrahedral stereocenter.

The number of possible stereoisomers increases rapidy: 2ⁿ ("n" being the number of stereocenters: 2, 4, 8, 16, 31, 64, 128, ...)

Diastereomers - Stereoisomers that are not enantiomers. They are neither superimposable nor mirror images of each other. 2,3-pentanediol



CH. CH₂



Right hand