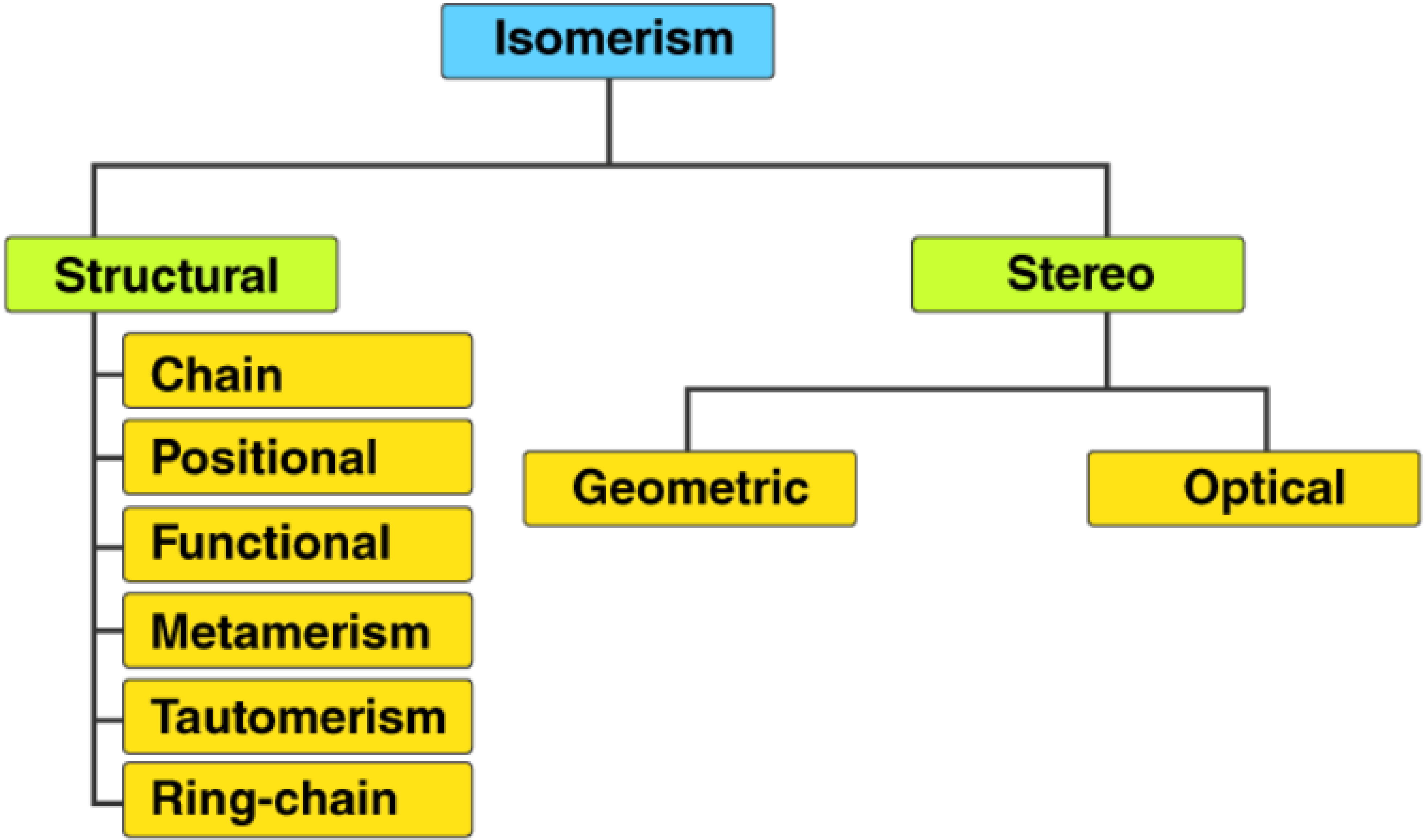
ISOMERISM


Isomerism
Structural
Stereo
Chain
Positional
Functional
Metamerism
Tautomerism
Ring-chain
Geometric
Optical

Structural Isomerism

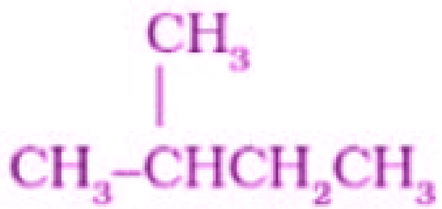
Structural isomerism is commonly referred to as constitutional isomerism. The functional groups and the atoms in the molecules of these isomers are linked in different ways. Different structural isomers are assigned different IUPAC names since they may or may not contain the same functional group.

Chain Isomerism

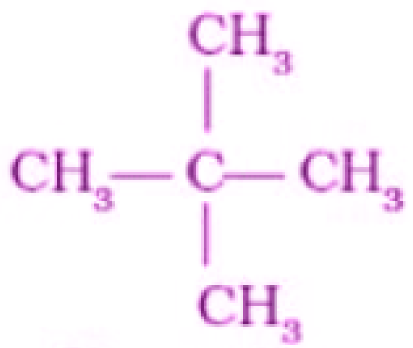
- It is also known as skeletal isomerism.
- The components of these isomers display differently branched structures.
- Commonly, chain isomers differ in the branching of carbon
- An example of chain isomerism can be observed in the compound C_5H_{12}, as illustrated below.

$CH_3CH_2CH_2CH_2CH_3$

Pentane



Isopentane
(2-Methylbutane)



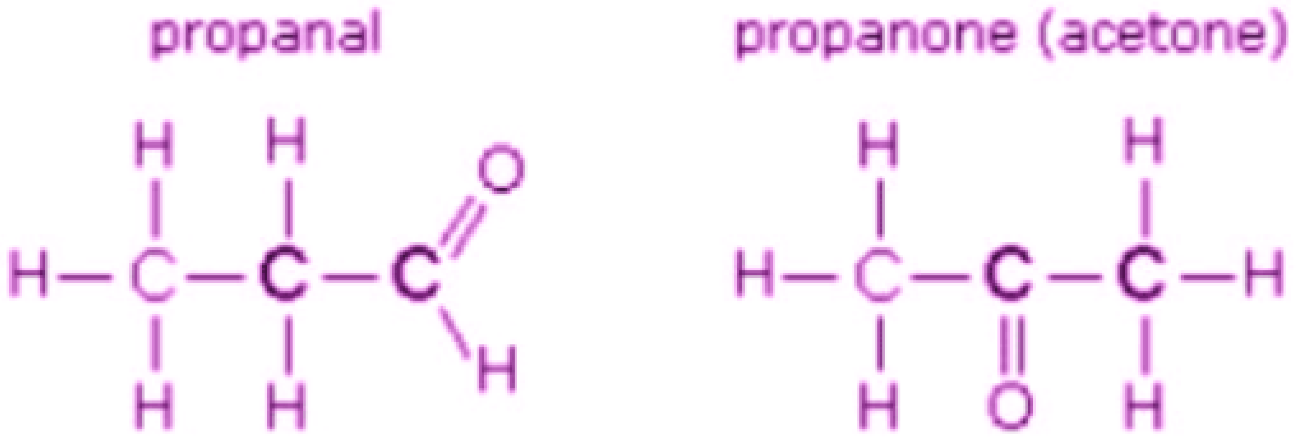
Neopentane
(2.2-Dimethylpropane)

Position Isomerism

- The positions of the functional groups or substituent atoms are different in position isomers.
- Typically, this isomerism involves the attachment of the functional groups to different carbon atoms in the carbon chain.
- An example of this type of isomerism can be observed in the compounds having the formula C_3H_7Cl.

Functional Isomerism

- It is also known as functional group isomerism.
- As the name suggests, it refers to the compounds that have the same chemical formula but different functional groups attached to them.
- An example of functional isomerism can be observed in the compound C_3H_6O.

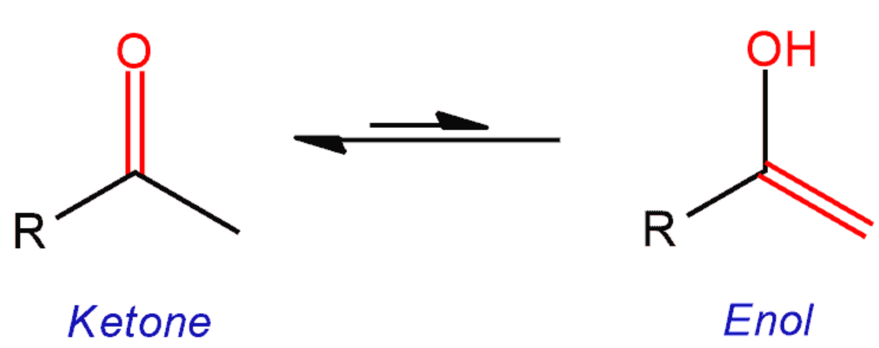


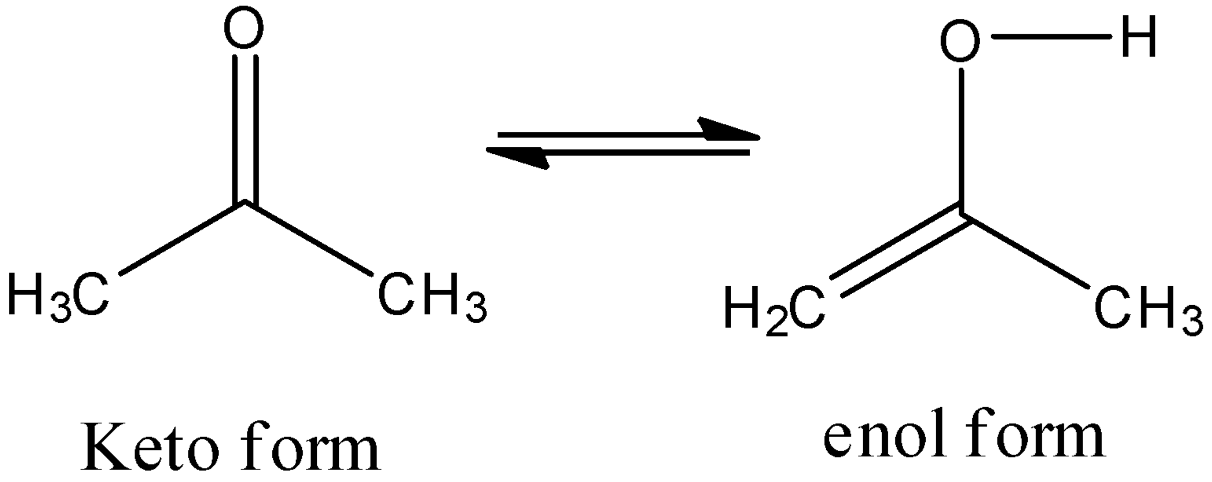
Metamerism

- This type of isomerism arises due to the presence of different alkyl chains on each side of the functional group.
- It is a rare type of isomerism and is generally limited to molecules that contain a divalent atom (such as sulphur or oxygen), surrounded by alkyl groups.
- Example: $C_4H_{10}O$ can be represented as ethoxyethane ($C_2H_5OC_2H_5$) and methoxy-propane ($CH_3OC_3H_7$).

Tautomerism

- A tautomer of a compound refers to the isomer of the compound which only differs in the position of protons and electrons.
- Typically, the tautomers of a compound exist together in equilibrium and easily interchange.
- It occurs via an intramolecular proton transfer.
- An important example of this phenomenon is Keto-enol tautomerism.





Ring-Chain Isomerism

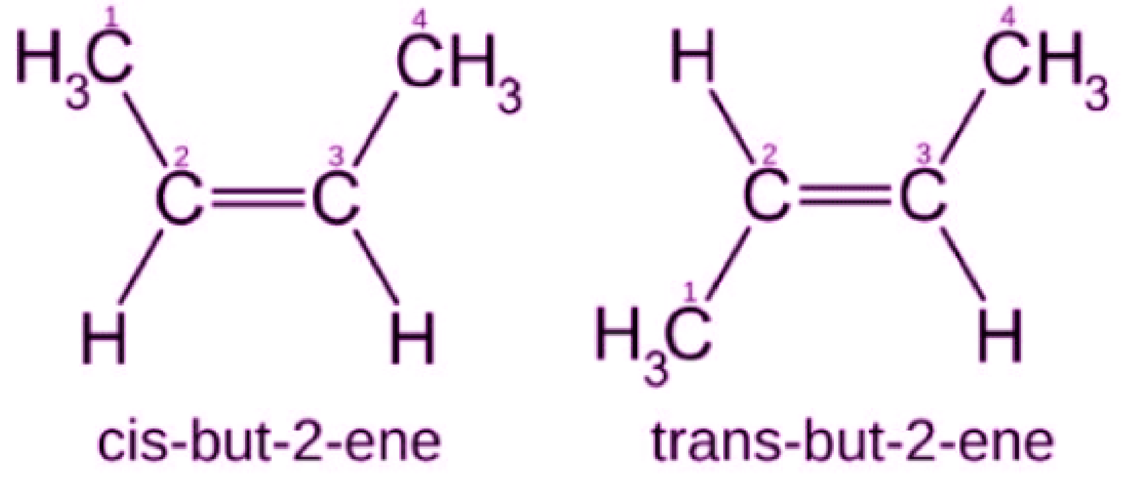
- In ring-chain isomerism, one of the isomers has an open-chain structure whereas the other has a ring structure.
- They generally contain a different number of pi bonds.
- A great example of this type of isomerism can be observed in C_3H_6. Propene and cyclopropane are the resulting isomers, as illustrated below.

Stereoisomerism

This type of isomerism arises in compounds having the same chemical formula but different orientations of the atoms belonging to the molecule in three-dimensional space. The compounds that exhibit stereoisomerism are often referred to as stereoisomers. This phenomenon can be further categorized into two subtypes. Both these subtypes are briefly described in this subsection.

Geometric Isomerism

- It is popularly known as cis-trans isomerism.
- These isomers have different spatial arrangements of atoms in three-dimensional space.
- An illustration describing the geometric isomerism observed in the acyclic But-2-ene molecule is provided below.

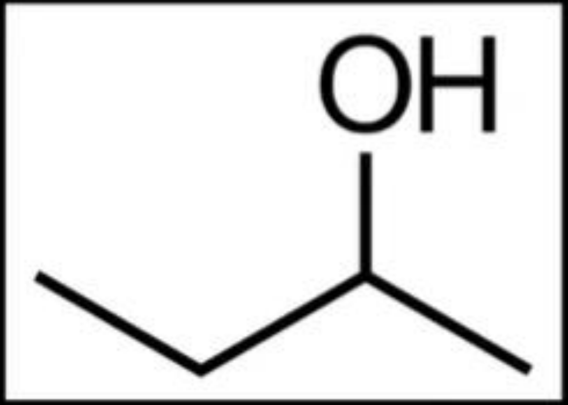


Optical Isomerism

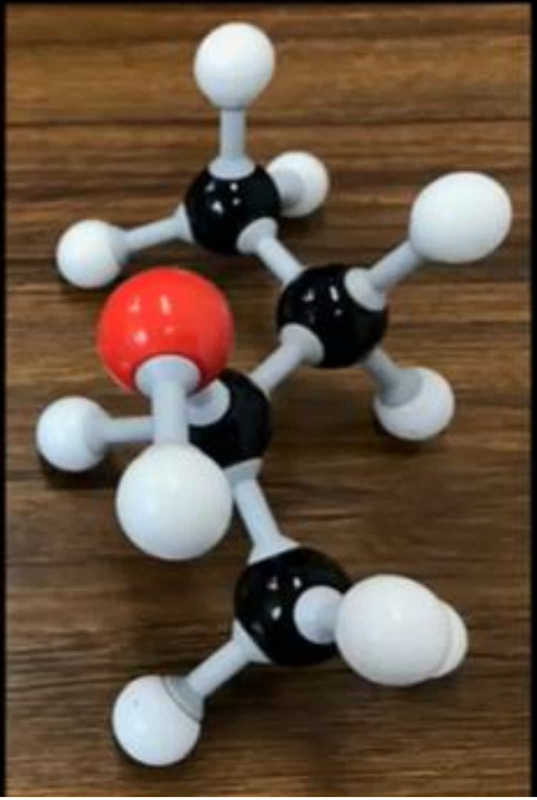
- Compounds that exhibit optical isomerism feature similar bonds but different spatial arrangements of atoms forming non-superimposable mirror images.
- These optical isomers are also known as enantiomers.
- Enantiomers differ from each other in their optical activities.
- Dextro enantiomers rotate the plane of polarized light to the right whereas laevo enantiomers rotate it to the left, as illustrated below.

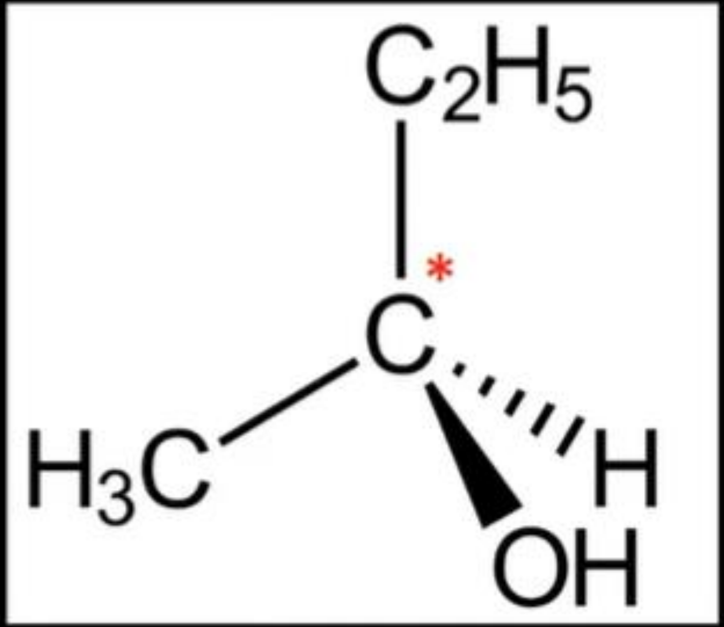
Optical isomerism is shown by chiral molecules that have a carbon atom bonded to four different atoms or groups (chiral center or asymmetric carbon).

butan-2-ol

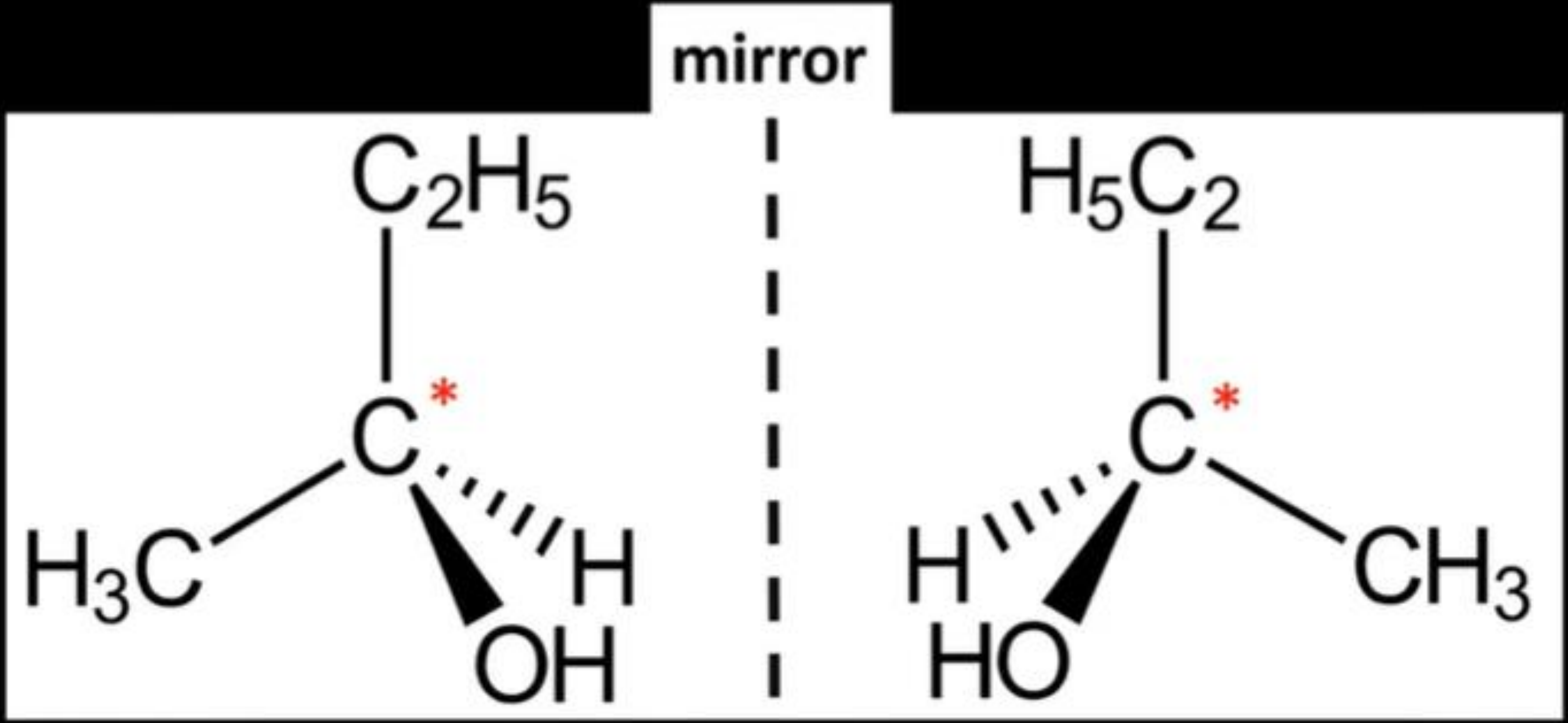


$CH_3CH_2CH(OH)CH_3$

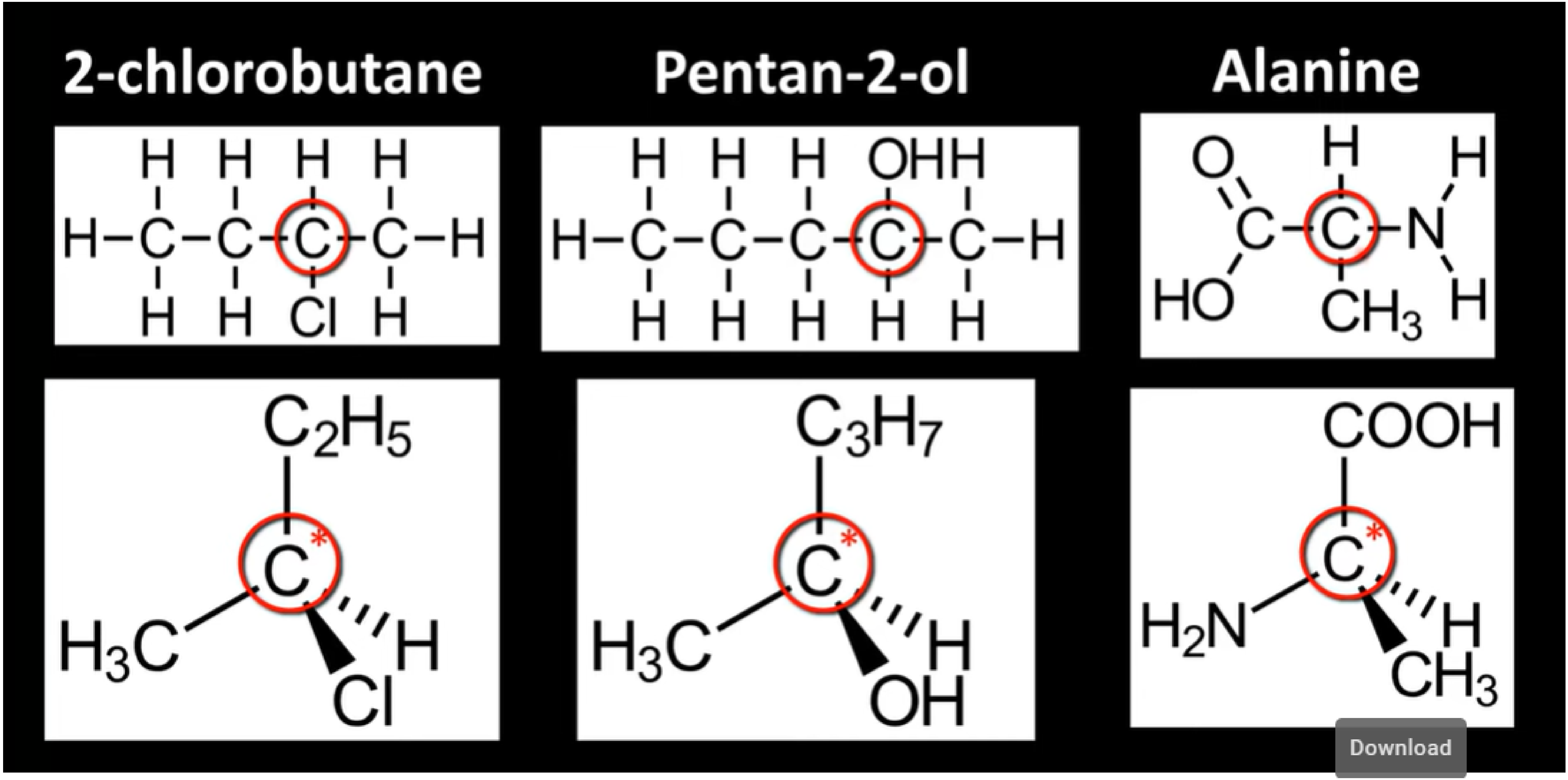




The four groups can be arranged in two three-dimensional configurations which are mirror images of each other.



butan-2-ol


2-chlorobutane
Pentan-2-ol
Alanine
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Enantiomers have identical physical properties, such as melting point and boiling point, except that they rotate the plane of plane-polarised light in opposite directions (optically active).

This property is used to distinguish between the two enantiomers of a chiral molecule.

The chemical properties of two enantiomers are also identical, except when they react with other chiral molecules (such as those found in the human body).

THANK YOU