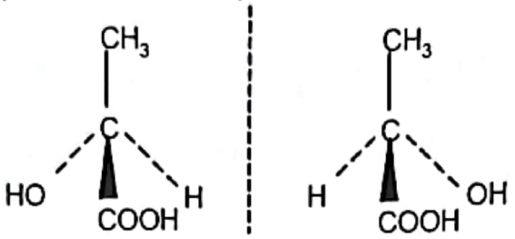
UNIT - V

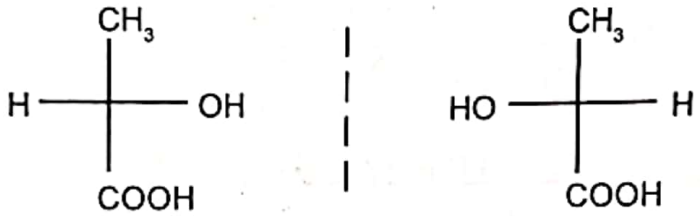
STEREO CHEMISTRY

5.1 Molecular representation : Carbon atom is bonded with 4 different groups **or** atoms then carbon is said to be asymmetric carbon. It is also called stereogenic centre **or** Chiral centre. These are optically active. The Chiral centre having tetrahedral carbon atom is three dimensional and it needs special representation. It is represented by the following methods.

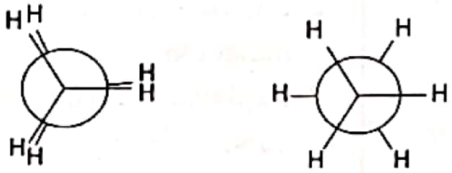
Wedge projection: The thick lines (wedge lines) indicated the bond in directed towards the viewer, normal line indicated the bond lines on the plane of paper and the dotted lines (- - - - -) lies behind the plane of the paper



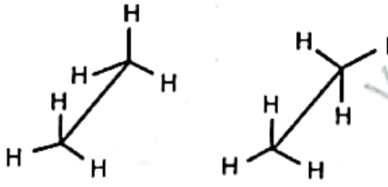
Fischer projection: Here the Chiral carbon is the intersection of the two lines. The horizontal line points towards the viewer and the vertical line points away from the viewer. This formal retains their configurations on rotation about 180⁰ .



Newman projection : Here near carbon is represented by a point with 3 atoms. The back side carbon is represented as a circle with three atoms.



Sawhorse projection : In this projection , the molecule is viewed along the molecular axis , the central C - C bond as a longer srtaight line. Upper end of the line is slightly tilted towards right or left hand side. The front carbon is shown at the lower end , the rear carbon shown at the upper end. Each carbon has three lines attached to three atoms. The lines are inclined at an angle of 120⁰.



5.2 Optical Activity : Normal light (sun light) consists of radiations of different wave lengths. When this light passed through the prism undergoes diffraction. It becomes mono-chromatic .It is called plane polarised light, i.e each monochromatic beam of light is passed through a Nicol prism the light becomes plane polarised, i.e beam of light vibrates in only one plane (direction). Plane polarised light is used to identify the optical activity of compound.

un polarised light plane polarised light

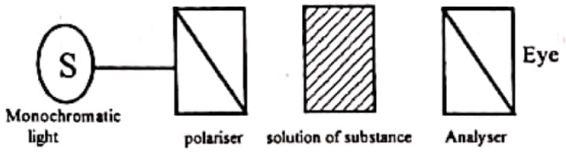
The tendensive of rotating the plane polarised light is known as Optical activity. The substance which rotate plane polarised light towards right sidely called dextro rotatory **or** d . The substance which rotate plane polarised light towards Left sidely called laevo rotatory **or** l. If the substance rotates towards both sides it is racemic mixture **or** ±. Racemic mixture is optically inactive due to opposite rotation i.e external compensation. The substance which does not rotate the plane polarised light is known as optically inactive compound.

The optical activity is expressed as specific rotation. $[\alpha]_D^t = \frac{\theta}{l \times c}$

Where, D = wave length [5893 for sodium] , t = temperature ,
C = concentration in gram / ml , θ = observed angle of rotation ,
l = Length in decimeters

Specific rotation is defined as the angle of rotation produced by one decimetre length of solution having one gram of the substance per cm^3.

5.3 Polarimeter : Optical rotation is measured in polarimeter. It contains two nicol prisms (polariser , Analyser).Monochromatic light of sodium lamp entres through the polariser. polariser and Analyser are parallel to each other. light is viewed from infront of the analyser , the view is of maximum brightness. As the analyser is rotated the light intensity decreases. When the rotation is 90^0 , the view is darkness.



The solution of substance placed in a glass tube between the two prisms , the view of light is appear as some bright.This is because substance rotate the plane polarised light by certain angle. The analyser is rotated for maximum darkness. The rotation of the plane polarised light is determined by a scale on the analyser , and then specific rotation is calculated.

I, Br, Cl, SO_3H, F, COR, OR, OH, NO_2, NR_2, $NHCOR$, NHR, NH_2, CCl_3, COCl, COOR, COOH, $CONH_2$, COR, CH_3 CH_2-OH, CN, CX_3, C_6H_5, CH_2R, CH_3, D and L

5.4 Condition for optical activity:

1. The compound should have asymmetric carbon.
2. The compound should not have elements of symmetry i.e., plane, axis, centre
3. The compound should not super impossible on its mirror images.

*** Concept of chirality :**

Chiral structures: A molecular structure which has no elements of symmetry and it do not super imposed on its mirror image is called chiral molecule.

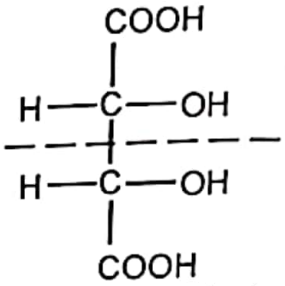
Eg: Alphabets **P, E, J** are chiral and the alphabets **A, O, M** are achiral.

*** Elements of symmetry :**

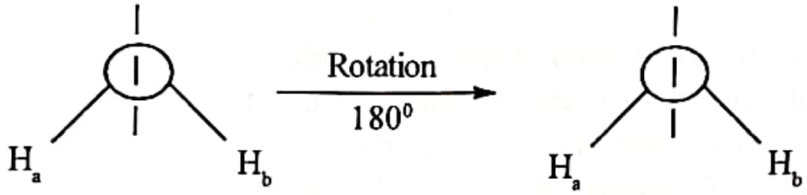
Some important terms involved in optical isomerism are

1. Plane of symmetry
2. Axis of symmetry
3. Centre of symmetry

Plane of symmetry: It is the plane which bisects the molecules into two equal and identical parts. These molecules are symmetry and they do not have optical activity.

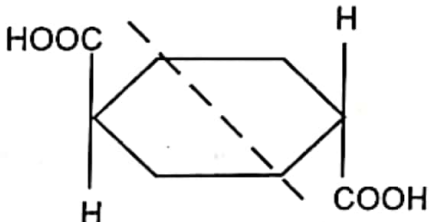


Axis of symmetry: It is axis through which it rotates the molecule and gives identical structure.



In the rotation of 360° two times identical structures possible . So , α fold axis of symmetry (C_α)

Centre of symmetry: It is a point with in the molecule such that any straight line drawn to it any point gives equal distances on the other side of an identical atom.



Trans Cyclo hexane 1,4 di carboxylic acid