

Semester-I (Hons)
Organic chemistry Notes

STEREOCHEMISTRY

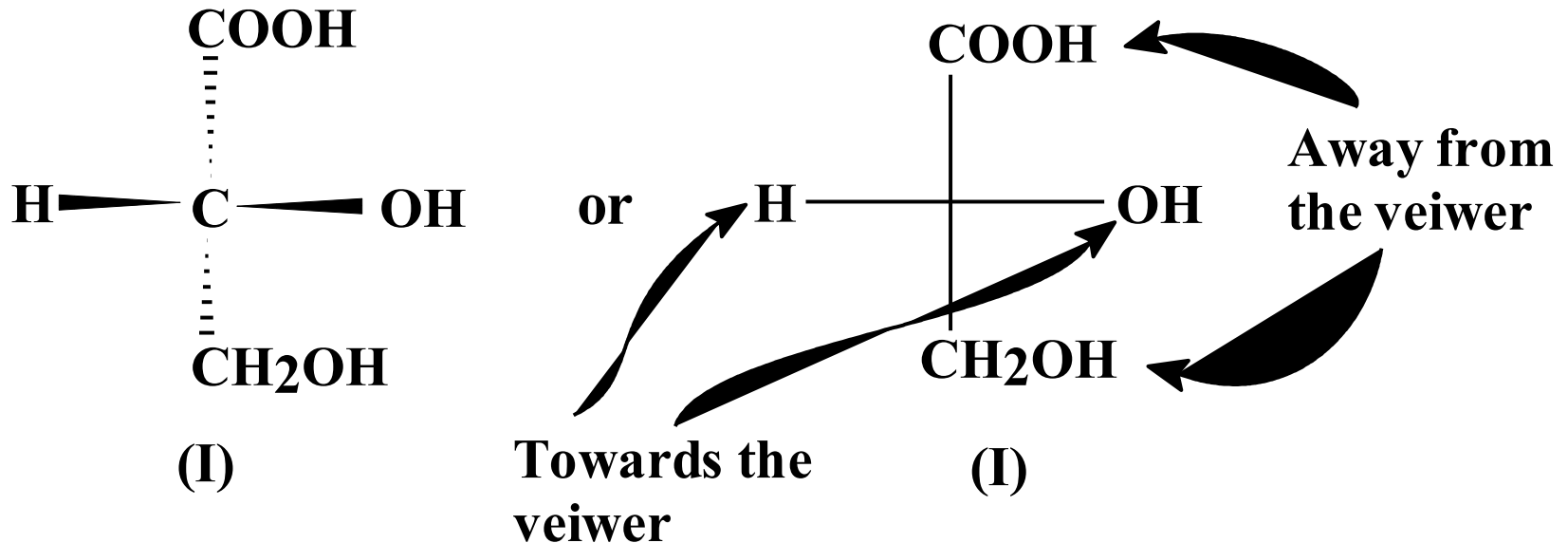
by

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PROJECTION FORMULAS OF CHIRAL MOLECULES

- Configuration of a chiral molecule is three dimensional structure and it is **not very easy to depict it on a paper** having only two dimensions. To overcome this problem the following four two dimensional structures known as projections have been evolved.
 - 1. Fischer Projection
 - 2. Newman Projection
 - 3. Sawhorse Formula
 - 4. Flying Wedge Formula

1. Fischer Projection

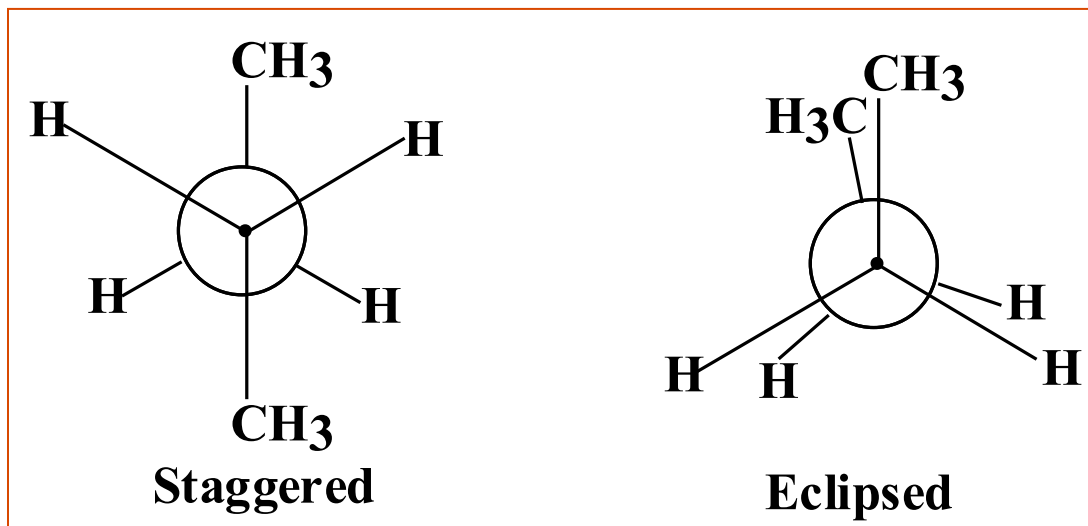
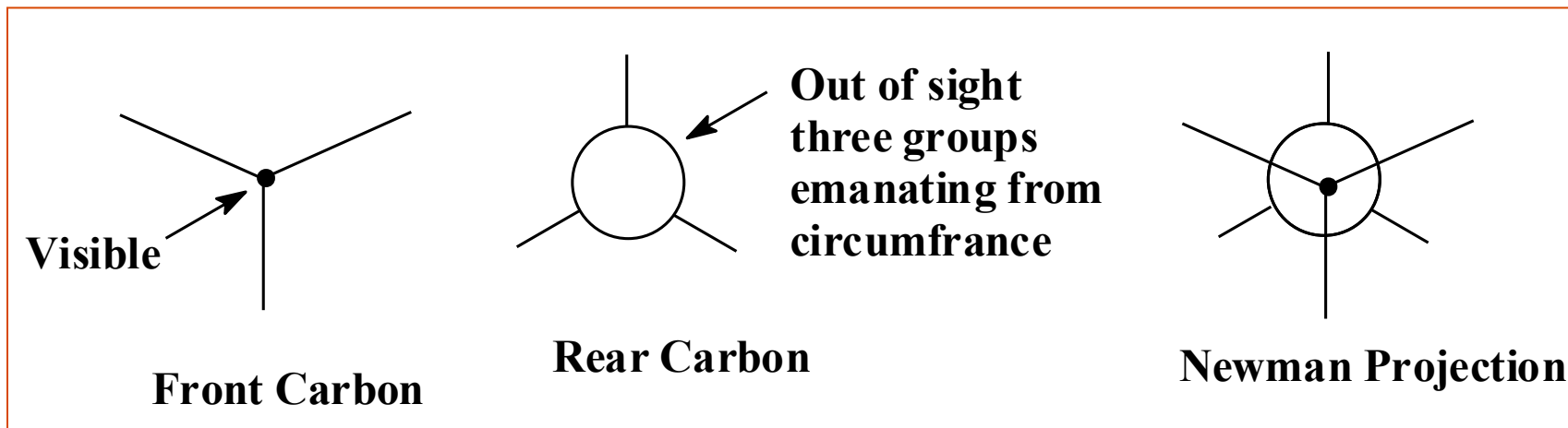


- **Characteristic features of Fischer projection:** Rotation of a Fischer projection by an angle of 180° about the axis which is perpendicular to the plane of the paper gives identical structure. However, similar rotation by an angle of 90° produces non - identical structure.

2. Newman Projection

- In Newman projection we look at the molecule down the length of a particular carbon - carbon bond. The carbon atom away from the viewer is called **'rear' carbon** and is represented by **a circle**. The carbon atom facing the viewer is called **'front' carbon** and is represented as **the centre** of the above circle which is shown by dot. The remaining bonds on each carbon are shown by small straight lines at angles of 120° as follows:
 - i) Bonds joined to 'front' carbon intersect at the central dot.**
 - ii) Bonds joined to 'rear' carbon are shown as emanating from the circumference of the circle.**

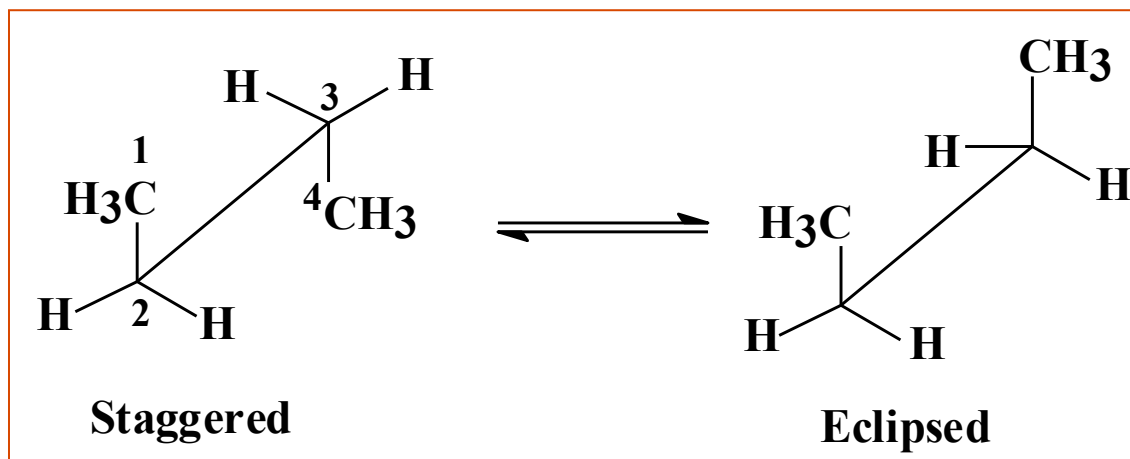
The concept of Newman projection for *n*-butane can be understood by the following drawings:



These conformations arise due to free rotation about the carbon - carbon single bond (front and rear carbon atoms).

3. Sawhorse projection

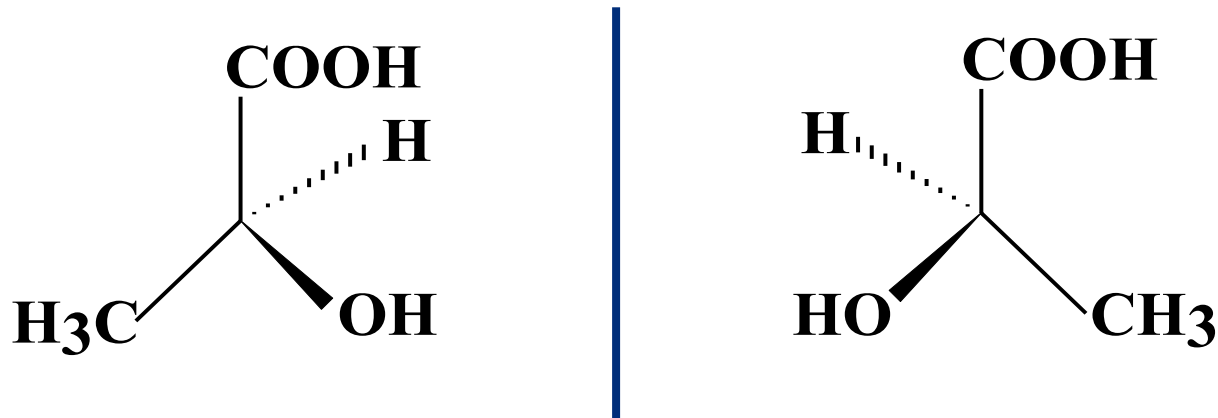
- The bond between two carbon atoms is shown by a longer diagonal line because we are looking at this bond from an oblique angle. The bonds linking other substituents to these carbons are shown projecting above or below this line.



- Due to free rotation along the central bond two extreme conformations are possible - the staggered and the eclipsed

4. Flying Wedge Formula

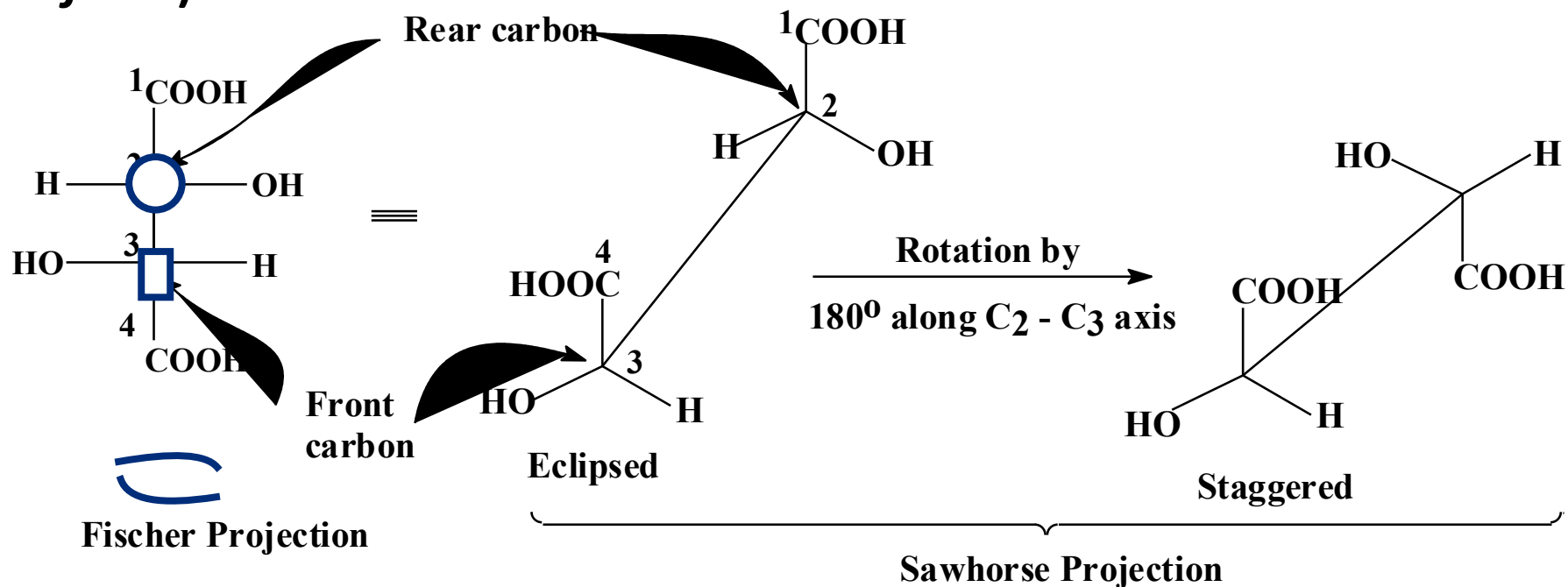
- It is a three dimensional representation.
- The flying wedge formulas of two enantiomeric lactic acids are shown below:



- Both these structure are mirror image of each other.
- (**Note:** The **main functional group** is generally held on the upper side in the **vertical plane**.)

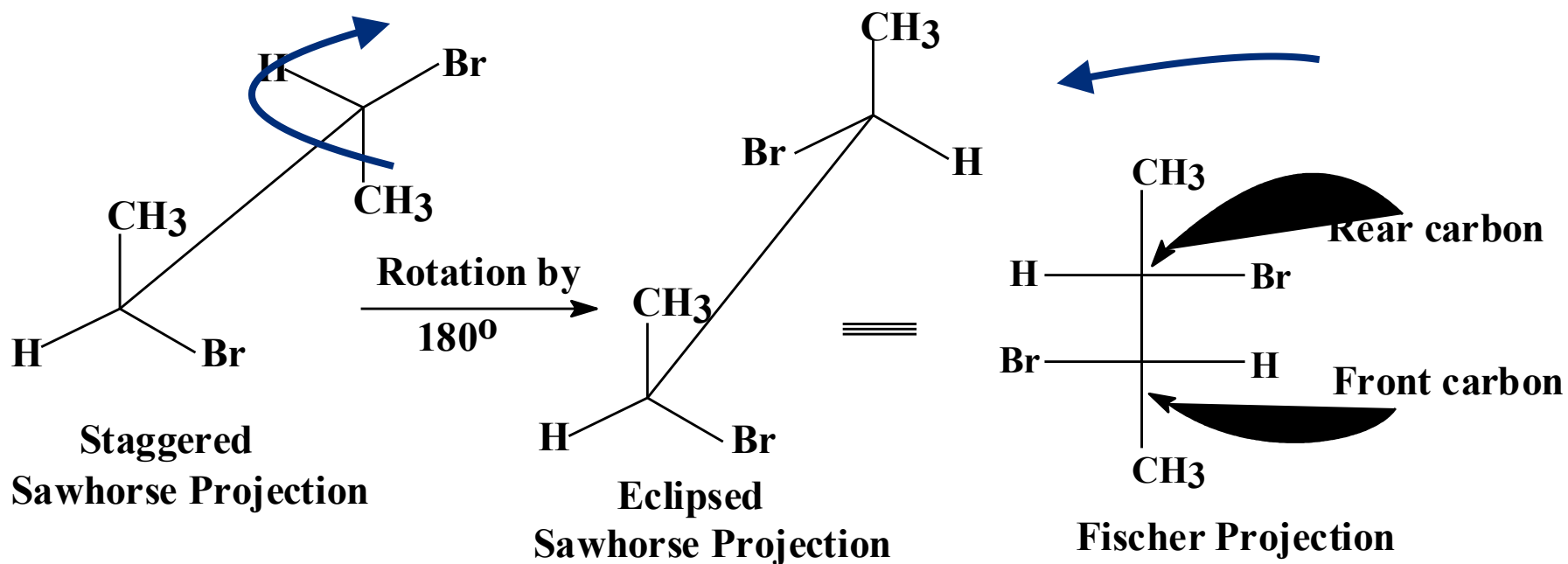
Conversion of Fischer Projection into Sawhorse Projection.

- Fischer projection of a compound can be converted into sawhorse projection first in the eclipsed form by holding the model in horizontal plane in such a way that the groups on the vertical line point above and the last numbered chiral carbon faces the viewer. Then one of the two carbons is rotated by an angle of 180° to get staggered form (*more stable or relaxed form*).

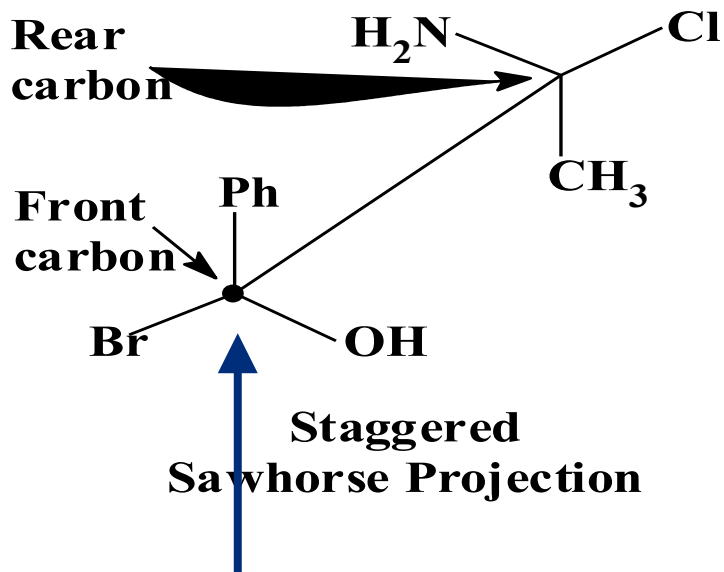


Conversion of Sawhorse projection into Fischer projection

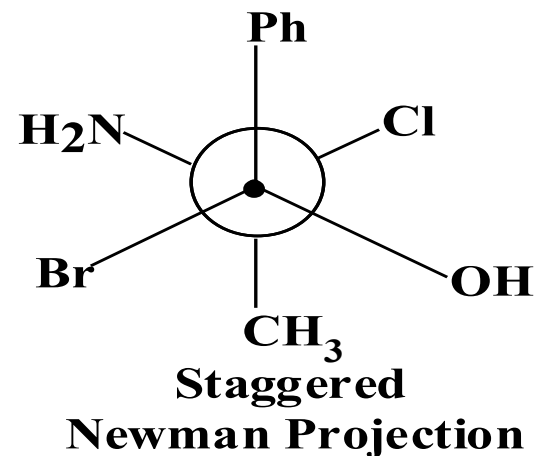
- First the staggered sawhorse projection is converted in eclipsed projection. It is then held in the vertical plane in such a manner that the two groups pointing upwards are away from the viewer i.e. both these groups are shown on the vertical line. Thus, for 2,3-dibromobutane.



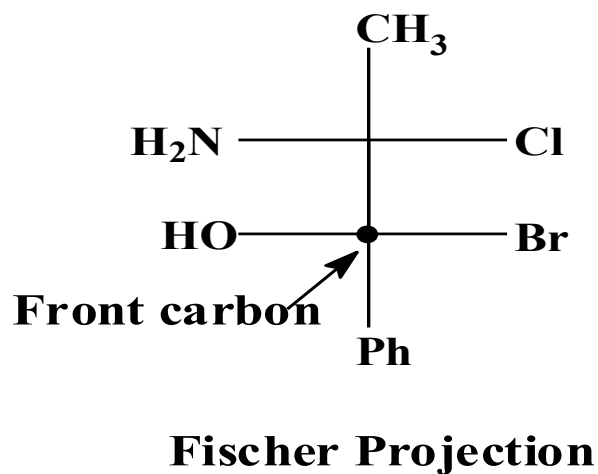
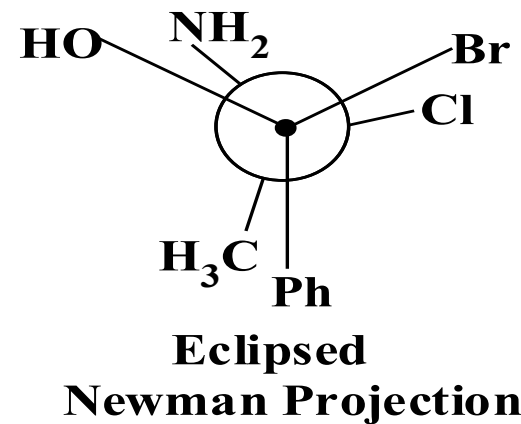
Conversion of Sawhorse to Newman to Fischer Projection



**View through
the front carbon**

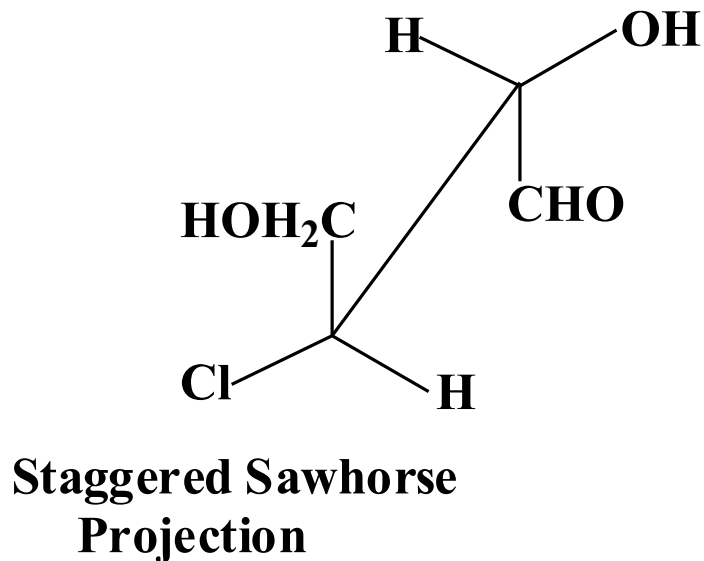
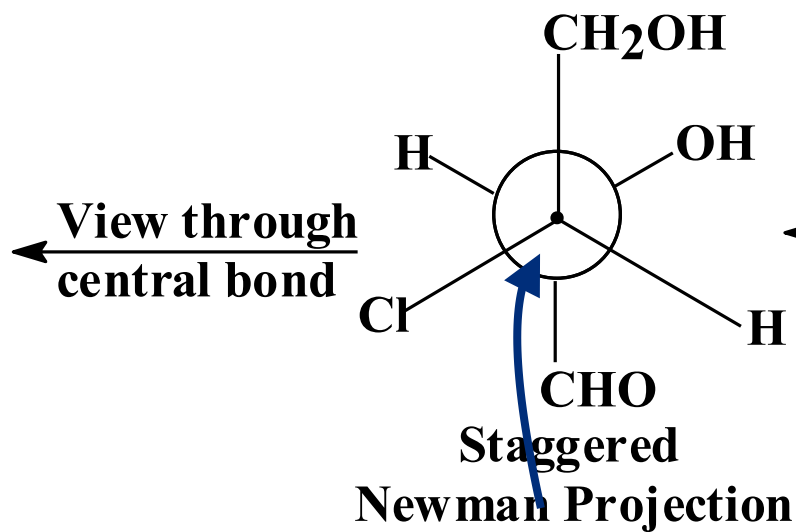
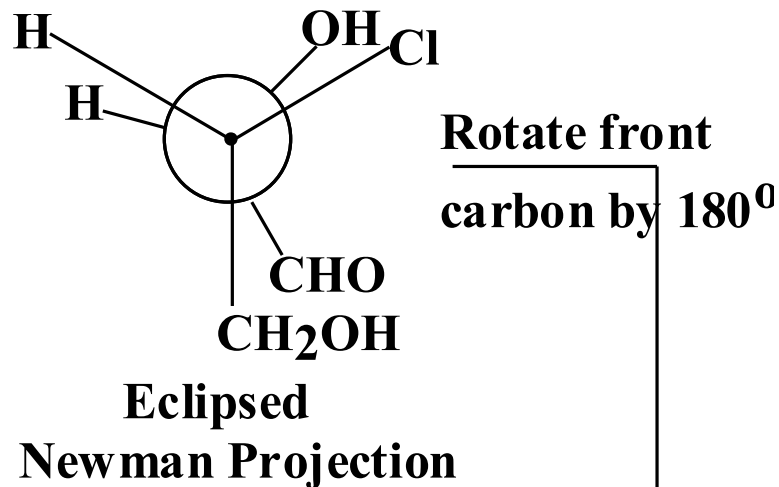
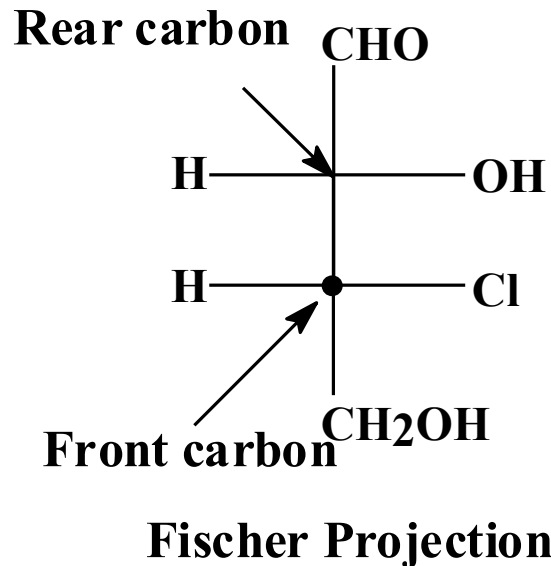


**Rotate the front carbon
along the central
bond by 180°**



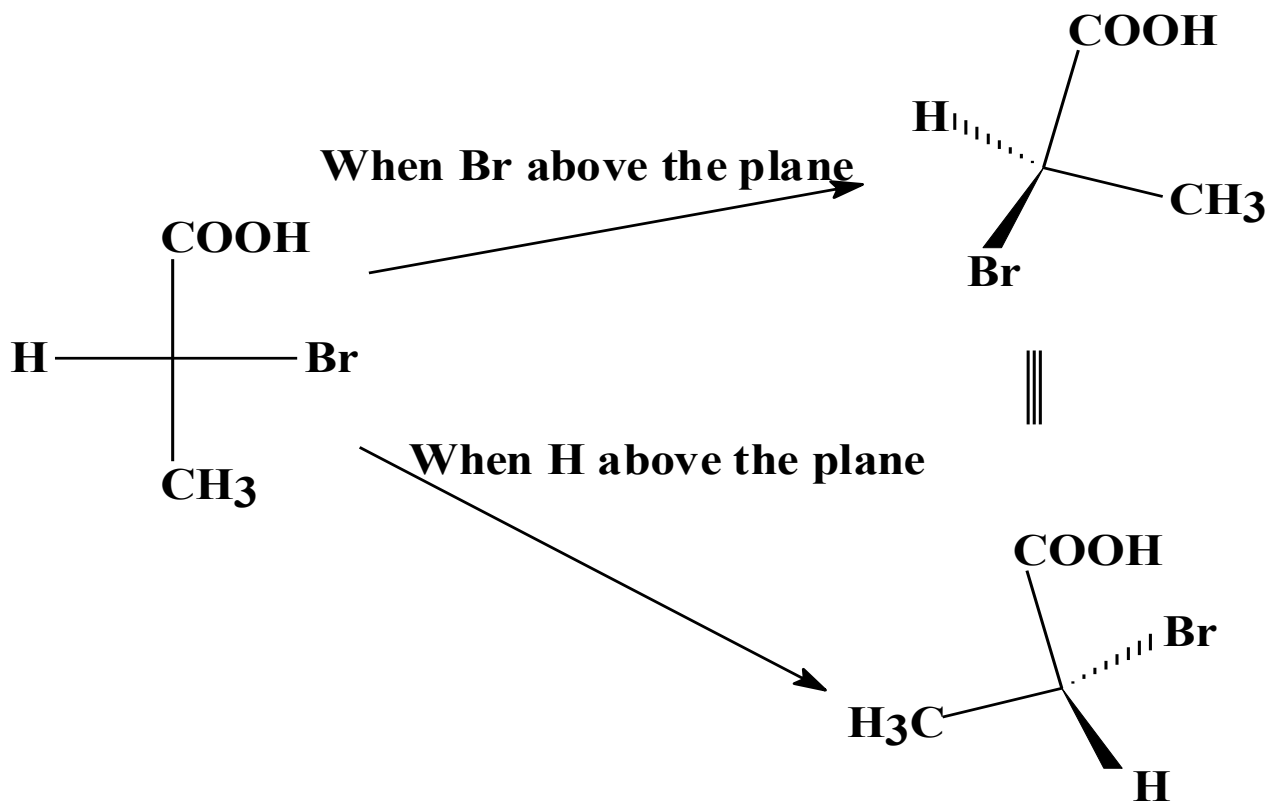
**Hold in vertical plane
keeping front carbon as the
lowest**

Conversion of Fischer to Newman to Sawhorse Projection



Conversion of Fischer Projection into Flying Wedge

- The **vertical bonds** in the Fischer projection are drawn in the plane of the paper using simple lines (—) consequently **horizontal bonds will project above and below the plane.**



Conversion of Flying Wedge into Fischer Projection

- The molecule is rotated (in the vertical plane) in such a way that the bonds shown in the plane of the paper go away from the viewer and are vertical.

