

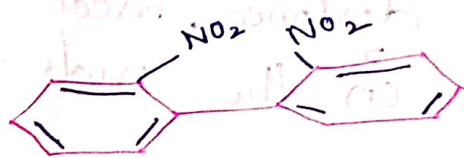
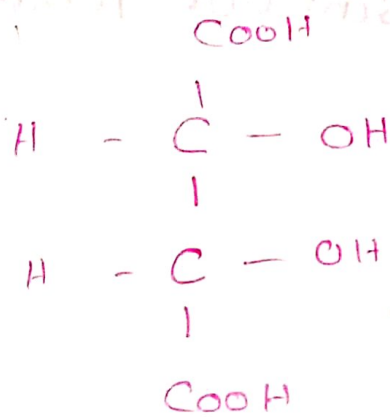
Elements of Symmetry:-

↓
Similarity

- * Plane of Symmetry
- * Center of " "
- * Axis " "

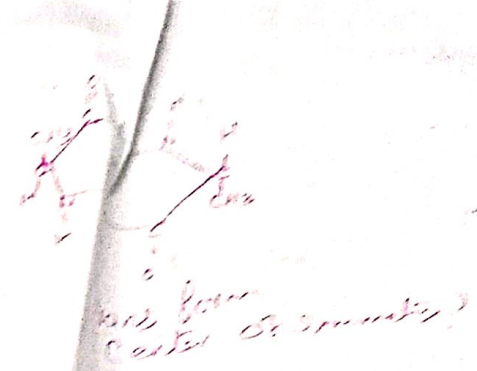
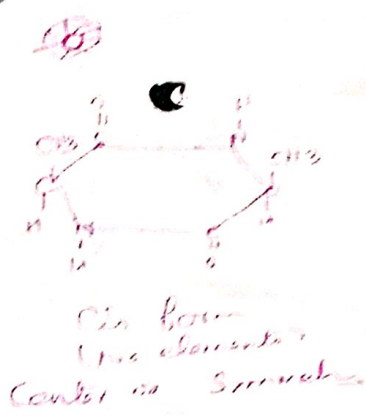
If any of the symmetry is present on the molecule, the molecule is superimposable on its mirror image. So, it is "Optically inactive" (X)

If all the elements of symmetry is absence, the molecule is "Non-Superimposable" on its mirror image, so that it is "Optically active".



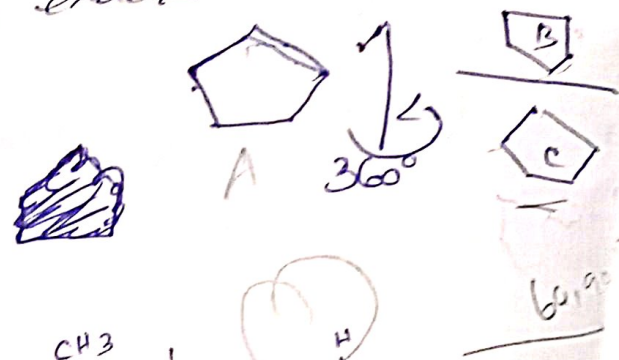
Plane of Symmetry (Mirror Plane) (σ)

A Plane of Symmetry is a imaginary plane that passes through a molecule such that atoms or groups of atoms on one side of plane is a mirror image of those on the other side. It is particularly useful if the molecule has two or more chiral centers.

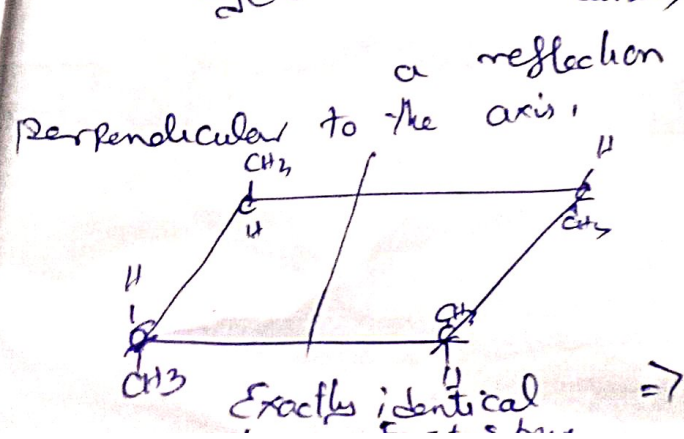
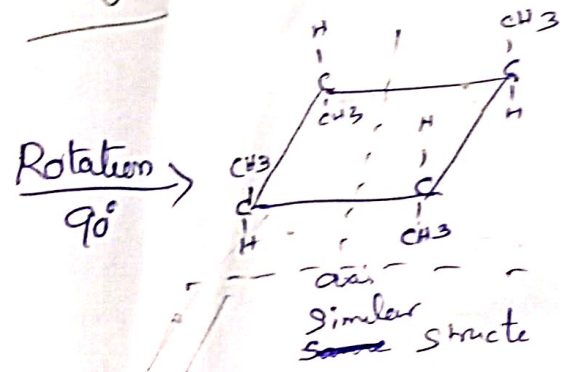
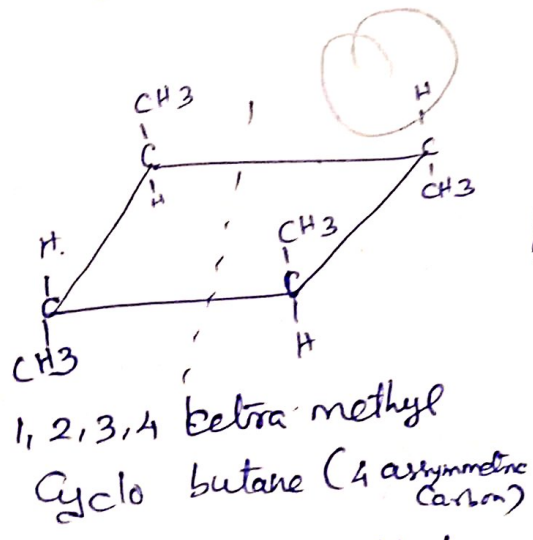


Alternating axis of Symmetry (S_n)

A molecule is said to possess an n -fold alternating axis of symmetry, if on rotating through an angle of $360^\circ/n$ about this axis and followed by a reflection of the resulting molecule in a plane perpendicular to the axis, then the mirror image is exactly identical to the original molecule.



If n is even then the molecule contains an $n/2$ -fold axis of symmetry.
If n is odd then the molecule does not contain alternate or n -fold axis.



the resulting molecule in a plane

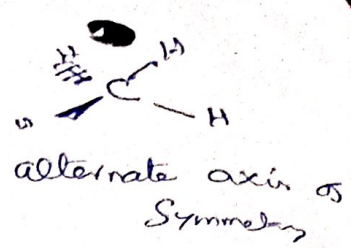
4 fold axis of Symmetry



Rotation by n



rotation by plane perpendicular



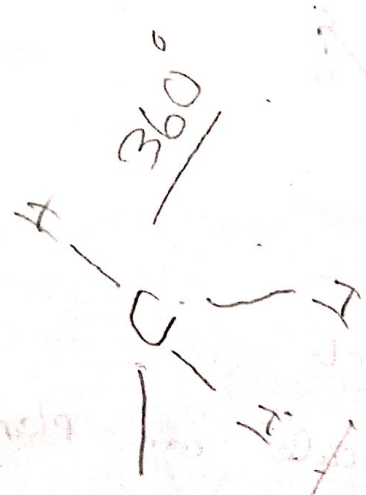
$$C_2 = \frac{360}{2} = 180^\circ$$

$$C_3 = \frac{360}{3} = 120^\circ$$

$$C_4 = \frac{360}{4} = 90^\circ$$

Simple axis of Symmetry (C_n) (only rotation)
 when a molecule is turned 360° about axis produces the molecule indistinguishable form original is said to have simple axis of Symmetry

Axis	angle of rotation	Notation
one fold	360°	C_1 (every compound contains)
2 "	180	C_2
3 "	120	C_3
4	90	C_4
6	60	C_6



$$\frac{360}{180} = 2 \quad C_2$$

$$\frac{360}{90} = 4 \quad C_4$$

$$\frac{360}{60} = 6 \quad C_6$$

$$\frac{360}{180} = 2 \quad C_2$$

$$\frac{360}{90} = 4 \quad C_4$$

$$\frac{360}{60} = 6 \quad C_6$$