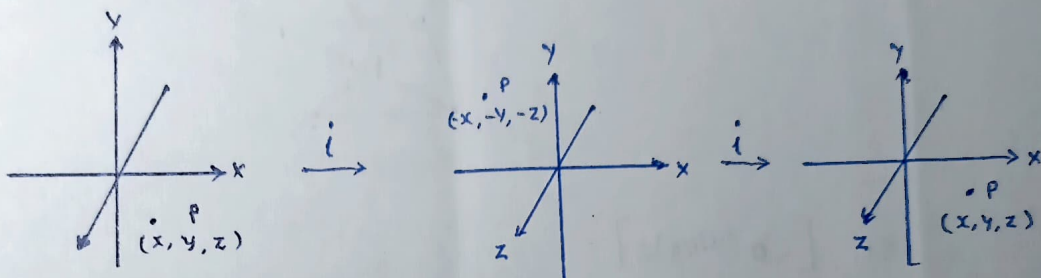


All atoms in the molecule, except the atom at the Centre of Symmetry are inverted during an inversion operation.

The unpaired atom (if any) has to be at the Centre of Symmetry

Thus, a molecule with more than one unpaired atom will not have Centre of Symmetry

Inversion operation can be shown as follows.



On the basis of above structure it is obvious that Repeat of Inversion Operation (i^2) gives initial representation.

Hence $i^n = E$ (where E is Identity)

If n is even

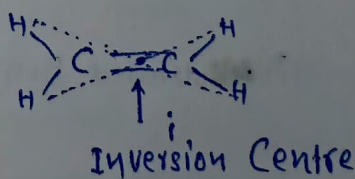
and

$i^n = i$

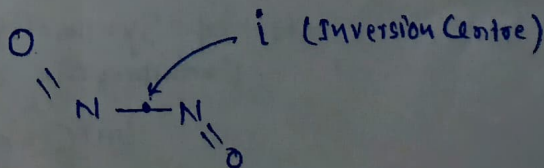
If n is odd.

Examples: Molecules have Centre of Symmetry.

(1) C2H4

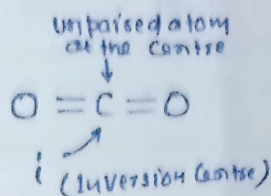


(2) N2O2

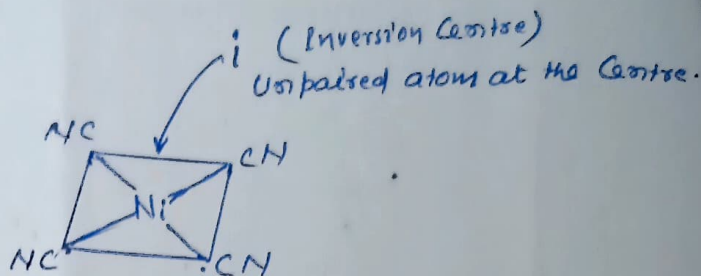


(3)

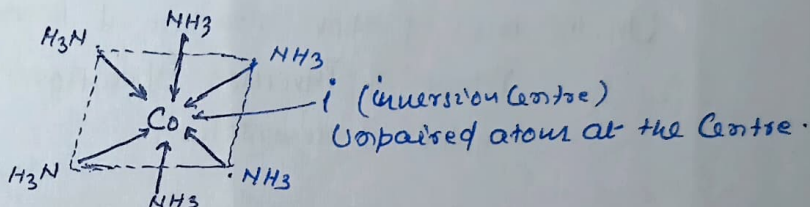
(3) CO_2



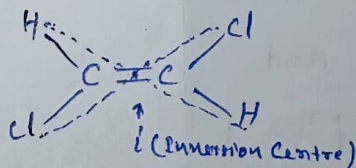
(4) $[\text{Ni}(\text{CN})_4]^{2-}$



(5) $[\text{Co}(\text{NH}_3)_6]$



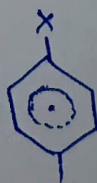
(6) Trans - $\text{C}_2\text{H}_2\text{Cl}_2$



(7) Benzene: - C_6H_6



(8) P-disubstituted Benzene



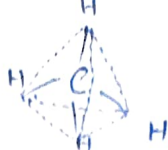
However, there are some molecules which do not have a Centre of Symmetry.

Examples are (i) CH_4 (ii) $\text{C}_2\text{H}_2\text{Cl}_2$

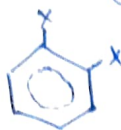
(iii) O-disubstituted Benzene

(iv) m-disubstituted Benzene

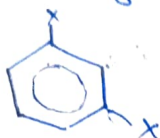
Its structure may be represented as follows.



O - distributed Benzene.



m - distributed Benzene.



Axis of Symmetry

or
(Rotation about an axis) C_n -

Axis of Symmetry is an imaginary axis passing through the molecule, around which the molecule can be rotated clockwise to take the nuclear frame work from one position to another indistinguishable position.

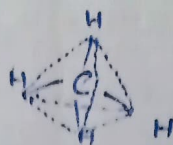
i.e. the rotation around the axis takes the molecule from one orientation to another equivalent orientation.

This is represented by C_n

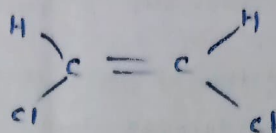
where n being the order of the axis. Hence, if θ is the smallest angle by which we rotate the object with respect to an axis and get an indistinguishable configuration, the rotation is referred to as a Symmetry Operator C_n .

$$C_n, \text{ where } n = \frac{360}{\theta}$$

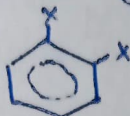
(1) CH_4



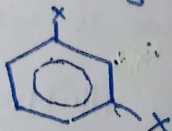
(2) $\text{Cis-CH}_2\text{Cl}_2$



(3) O-distributed Benzene.



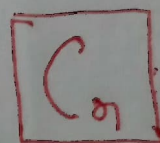
(4) m-distributed Benzene.



[3] Axis of Symmetry

or

(Rotation about an axis)



Axis of Symmetry is an imaginary axis passing through the molecule, around which the molecule can be rotated clockwise to take the nuclear framework from one position to another indistinguishable position.

i.e. the rotation around the axis takes the molecule from one orientation to another equivalent orientation.

This is represented by C_n

where n being the order of the axis. Hence, if θ is the smallest angle by which we rotate the object with respect to an axis and get an indistinguishable configuration, the rotation is referred to as a Symmetry Operation.

C_n

where

$$n = \frac{360}{\theta}$$