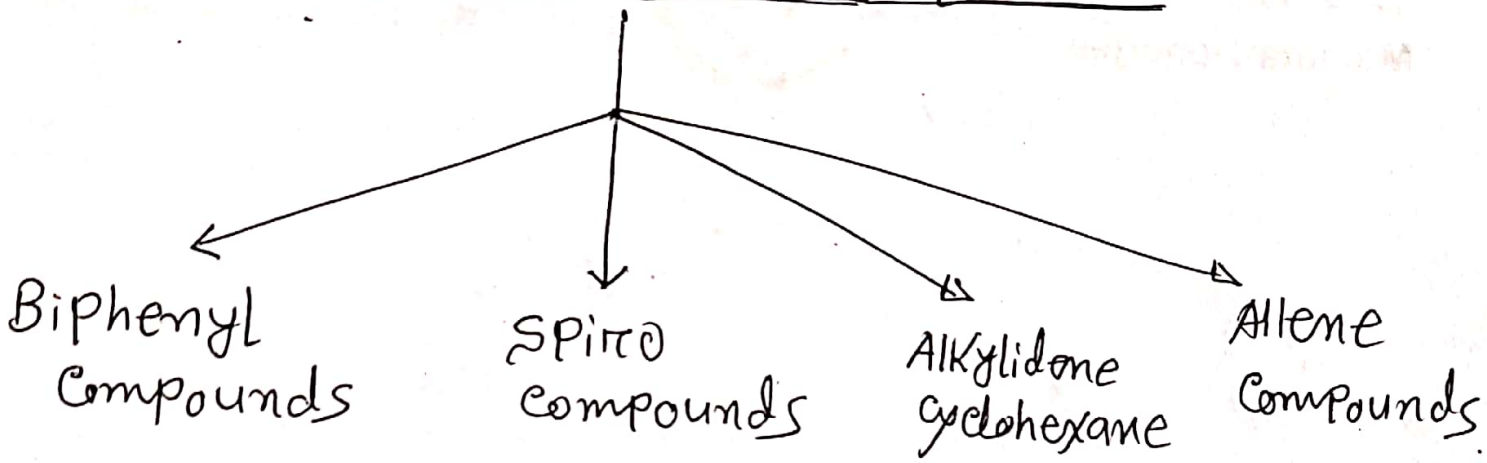
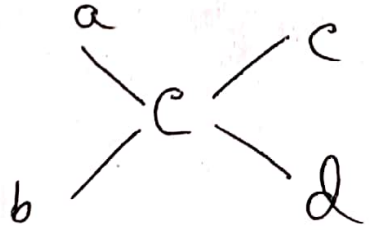
Examples of optically active compounds without chiral sp^3- Carbon



There are two types of chirality

1) Central chirality
2) Axial chirality

* Central chirality ⟶ 

($a \neq b \neq c \neq d$).

sp^3C- chiral carbon.

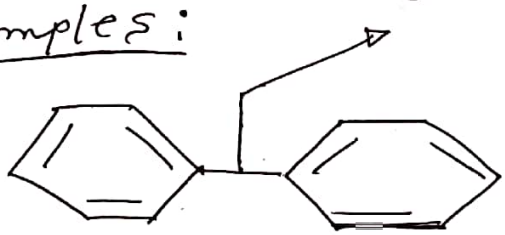
⟸

(Discussed in SEM-I Stereochemistry).

In SEM-II - stereochemistry we will discuss optical Property in a compound due to axial chirality.

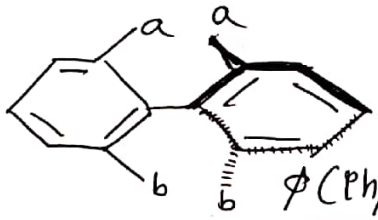
$(sp^2C - sp^2C)\sigma$ bond is Pivotal bond

Examples:



ϕ (Ph/ph) = 0°

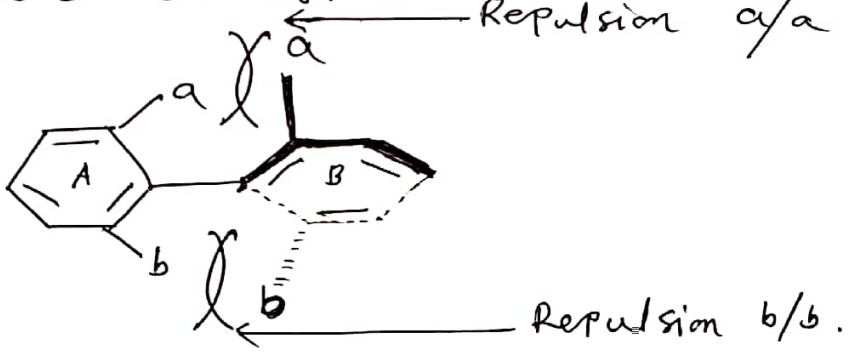
but



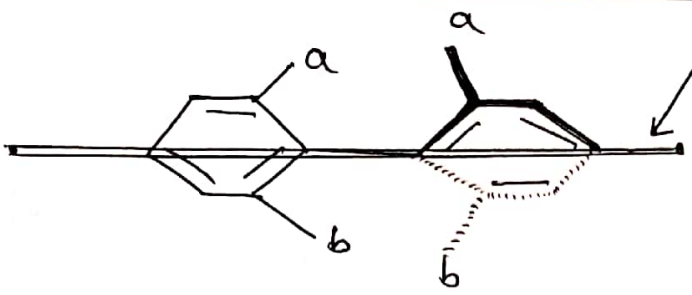
ϕ (Ph/ph) = 90°

This biphenyl will show optical activity when ϕ (Ph/Ph) = 90°. i.e. dihedral angle between two Phenyl Group is 90° i.e when they are orthogonal to each other.

Normally in unsubstituted biphenyl two Ph rings are Parallel. but when sterically hindered Group or bulky Groups are Present at ortho Position then to avoid repulsion (both steric & electronic) two Ph rings forced to become Perpendicular to each other.

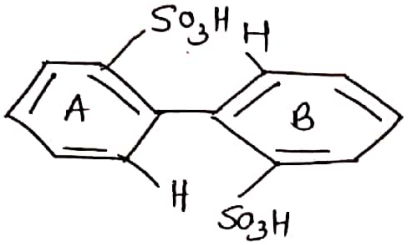


Now if you imagine A ring as Plane and cut the B ring then B ring will be seen as unsymmetrical as $a \neq b$.
Similarly if you imagine B ring as plane and cut the A ring then A ring will be found unsymmetrical. as $a \neq b$. so neither A nor B ring has Plane of Symmetry.



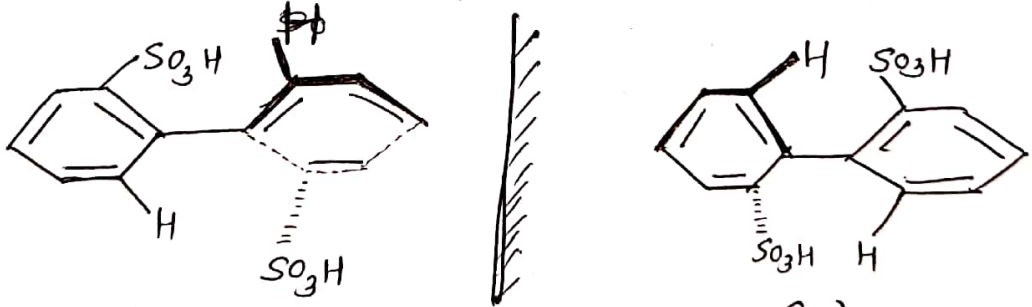
This axis is called chiral axis now. So the comp. is OA. because of axial chirality.

See the following examples:

1. 

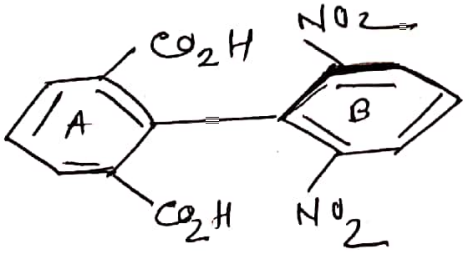
⟸ OA. Here SO3H/H. repulsion is sufficient to make A and B ring orthogonal to each other.

So this comp. has both ⊕ and ⊖. isomer. But ⊕ and ⊖ isomers are not interconvertible. So this comp. is resolvable. It means that ⊕ and ⊖ isomer of this compound exist separately always. So actual structure of this compound is given below.

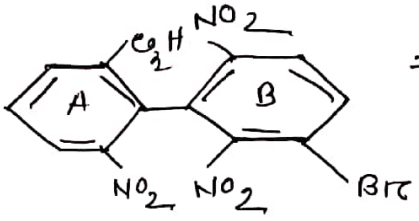


(+) (−).

mirror images to each other.

2. 

⟹ OI. As here. both A and B. rings are symmetrical although A/B are orthogonal to each other.

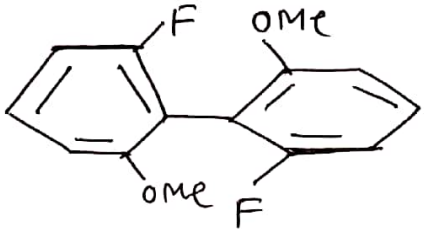
3. 

⟹ OA.

$\phi(A/B) = 90^\circ$

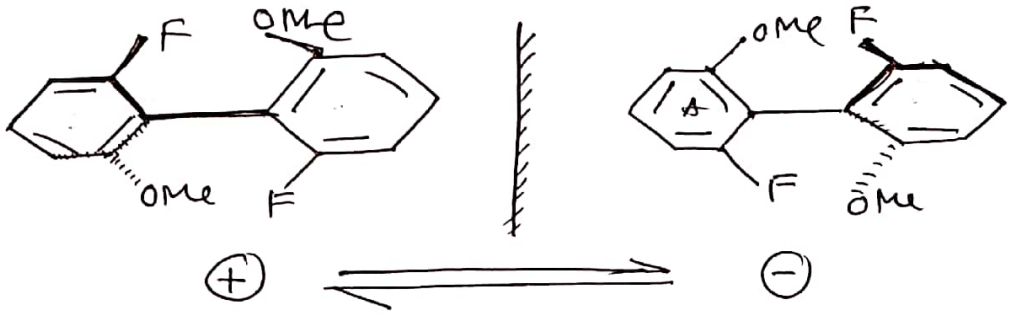
A ⟶ unsymmetrical

B ⟶ unsymmetrical because of Br, if Br was absent then B would be symmetrical.

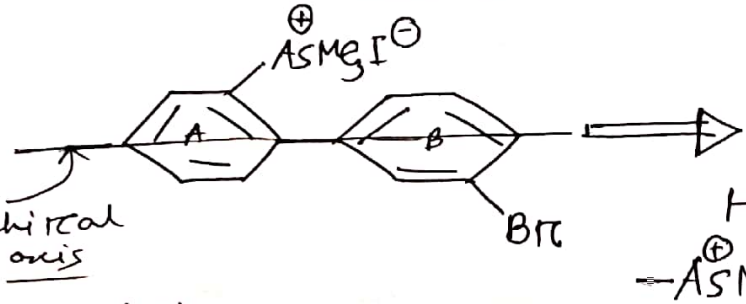
4. 

⟹ OA. But non resolvable i.e. (+) and (−) isomer of this compound is interconvertible.

If you prepare (+) isomer of this comp then after sometime (+) isomer will be converted to (−) isomer until there is equal amount of (+) and (−) isomer i.e. racemic mixture will be produced.



(interconvertible)

5. 

⟹ OA and resolvable

Here single bulky group $-\overset{\oplus}{As}Me_3I^{\ominus}$ produce huge repulsion with small H-atom. so A/B are ⊥ to each other. Both A and B ring are unsymmetrical. (+) and (−) isomer of this comp. is not interconvertible.