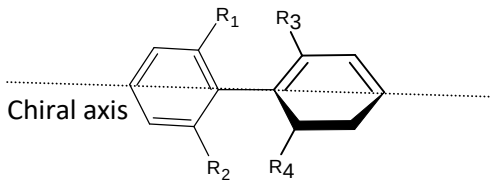
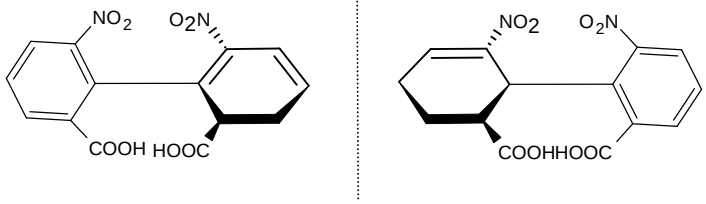
Atropisomerism:

When biphenyls are appropriately substituted, steric interactions between ortho-substituents are sufficient to prevent rotation of aromatic rings relative to each other about the sigma bond joining them. As a result, the preferred conformations are those in which aromatic rings lie in a perpendicular plane, as shown:

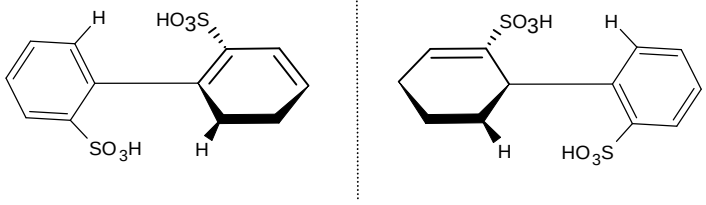


Such minimum energy conformations do not possess a plane of symmetry or center of symmetry when appropriately substituted (**$R_1 \neq R_2$, $R_3 \neq R_4$**). Therefore, they exhibit **enantiomerism**. **Atropisomerism** is a type of stereoisomerism that arises due to restricted rotation around a single bond, typically in biphenyl systems, where steric hindrance from appropriate substituents prevents free rotation. As a result, the molecule adopts stable, isolable conformations that are non-superimposable mirror images of each other, known as **atropisomers**.

Two pairs of examples are given below:

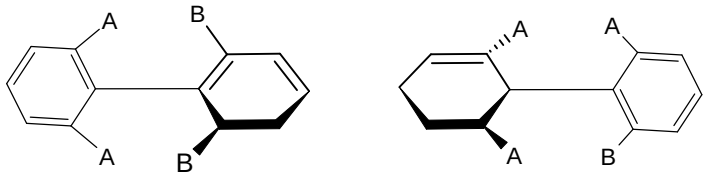


Atropisomers of 6,6′-dinitrodiphenic acid



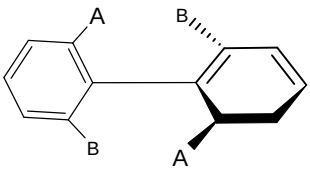
Atropisomers of biphenyl-2,2-disulphonic acid

Ortho-substituted biphenyls can be of different types based on the nature of the substituents:

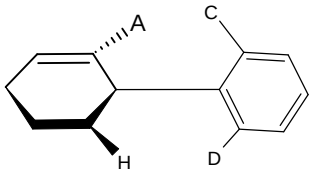


I

II



III



IV

Of these, (I) and (II) are optically inactive (achiral) because they possess a plane of symmetry. Biphenyl of the type (III) is dissymmetric and hence optically active. Biphenyl of the type **(IV)** is asymmetric because it has no element of symmetry other than the C_1 and hence optically active.