STEREOCHEMISTRY

Degree-II (H) , Paper-IV ,Chapter-4

Lecture -9 , Date : 06-08-2020

Optical Isomerism Continue..

Optical Isomerism in Compounds Containing no Chiral Carbon Atom :-

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The basic requirement for a compound to be optically active is its non-superimposability of its mirror image.

Although the largest number of known optically active compounds are optically active due to the presence of chiral carbon atom, some compounds are also known which do not possess any chiral carbon atom, but on the whole their molecules are chiral, hence, they are optically active.

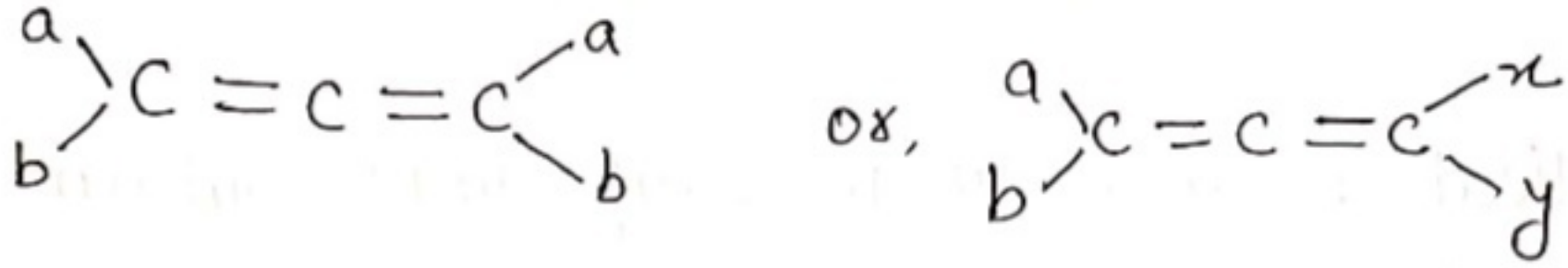
various types of compounds belonging to this group are described below.

Allenes

Allenes are the organic compounds of the following general formula -

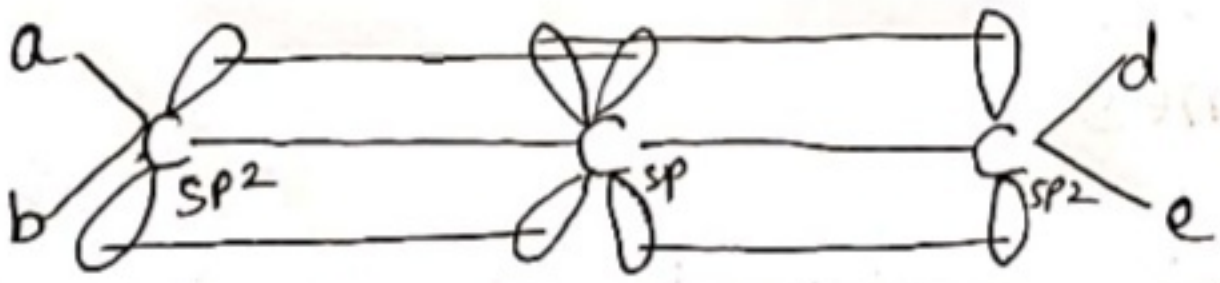
$$\rangle C=C=C\langle$$

* The allenes exhibit optical isomerism provided the two groups attached to each terminal carbon atom are different.

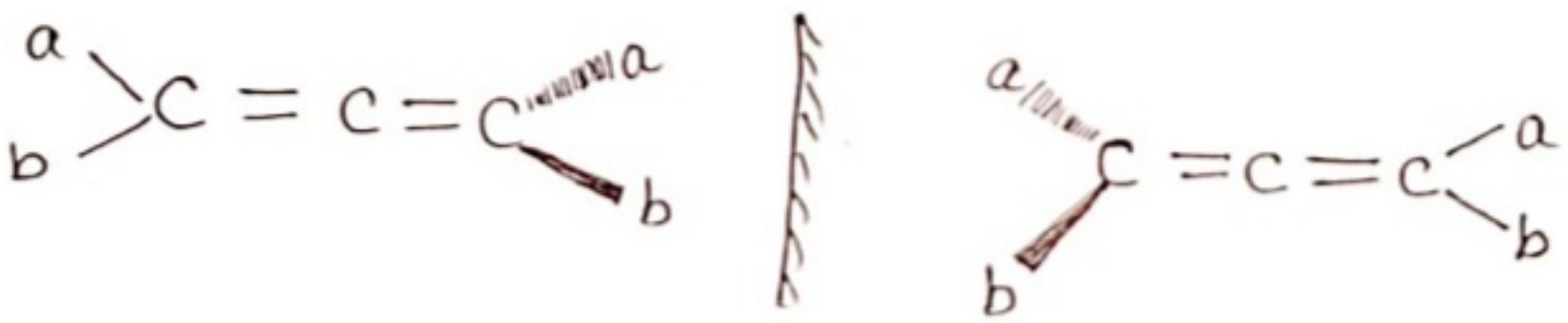


* The optical isomerism in allenes can better be explained in terms of molecular orbital theory.
* In allenes the two terminal carbon atoms are in sp^2 hybridised state and the central carbon atom sp hybridised
* The central carbon is linked linked to adjacent carbon atoms by two collinear σ-bonds and two π-bonds.
* The two π-bonds are in planes at right angle to each other.

The plane of π_x-bond is perpendicular to the plane of paper and the plane of π_y-bond is in plane of paper.



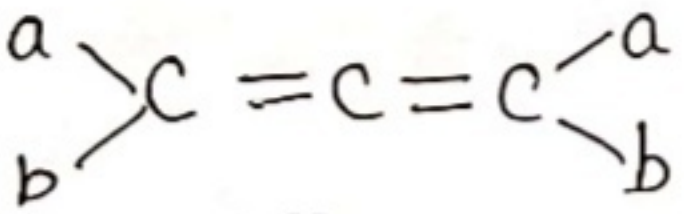
As is well known that in trigonal state, the π-bond is at right angle to plane of the σ-bonds, the terminal groups attached to trigonal carbon atom lie in planes perpendicular to each other. The molecule, thus possesses neither plane nor a centre of symmetry and forms a non-superimposable mirror image, hence the allene molecules, on the whole are asymmetric and optically active.



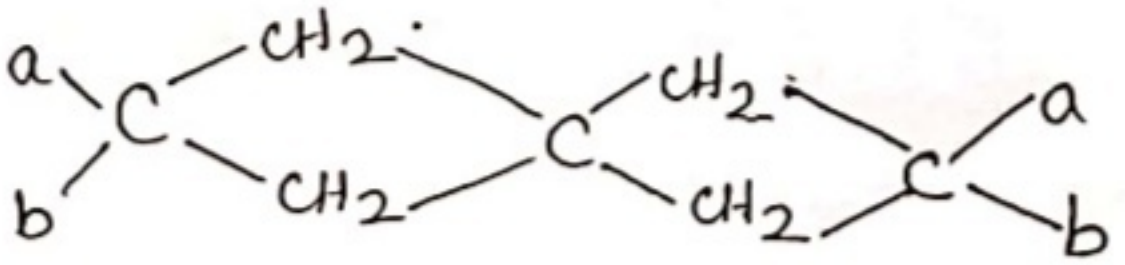
Enantiomeric allenes

SPIRO COMPOUNDS (SPIRANS)

When both the double bonds in allenes are replaced by rings, the resulting system is known as spiro compounds or spirans, eg.



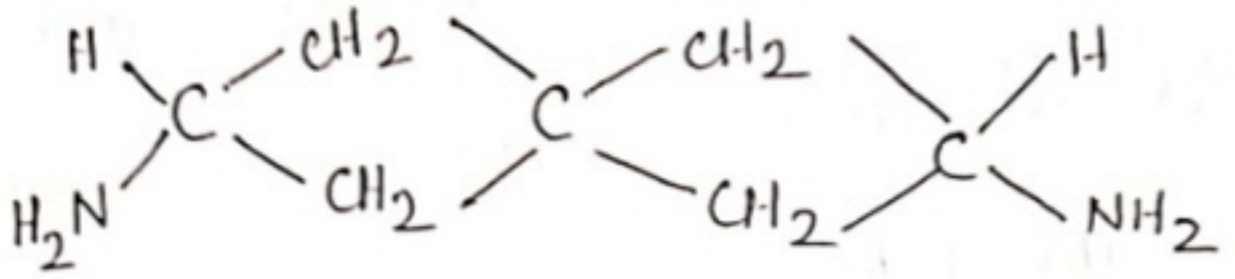
Allene



Spiran

In spiran, the two rings are perpendicular to each other, and hence suitable substitution at either of the ends of the system (ie; 'a' and 'b') or within the rings will make the molecule disymmetric ie; optically active.

eg



Diaminospirocycloheptane

BIPHENYLS

(Optical Isomerism Due to Restricted Rotation)

Suitable substituted diphenyl compounds are also devoid of individual chiral carbon atom but the molecules are chiral due to restricted rotation around the single bond between the two benzene nuclei and hence they must exist in two forms which are non-superimposable mirror images of each other, and in practice also it is found so

Such type of stereoisomerism, which is due to restricted rotation about single bond, is known as atropisomerism and the stereoisomers are known as atropisomers.

To be continued in next lecture...