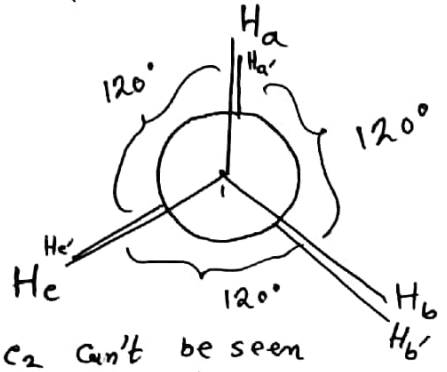
Conformational Isomerism

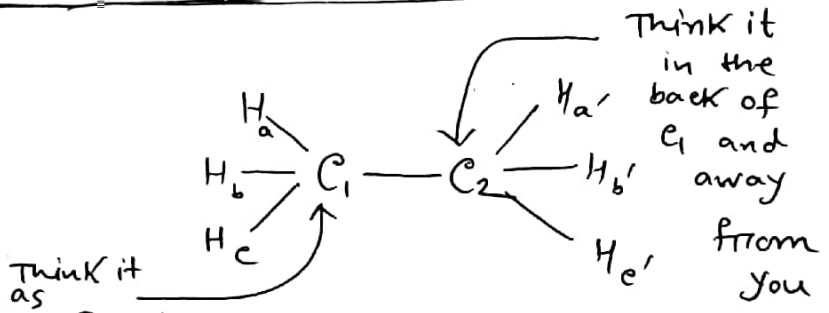
This type of isomerism arises due to free rotation of C–C single bond. When one carbon along its various groups rotate with other carbon there generates various spatial arrangements of groups of one carbon around the various groups of other carbons. Such arrangements are called conformational isomers or rotational isomers and this type of isomerism is known as conformational isomerism. The energy difference between these isomers are very less.

Representation of conformational isomers:

Newmann Projection formula:



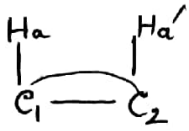
C_2 can't be seen as it is exactly at the back of C_1 but the associated bonds from C_2 spread over from the circumference of the cyclic/spherical ball.



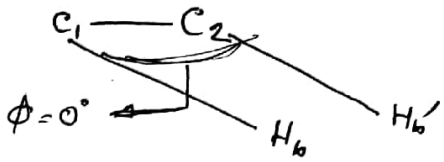
when C_1–Ha C_2–Ha' are parallel.

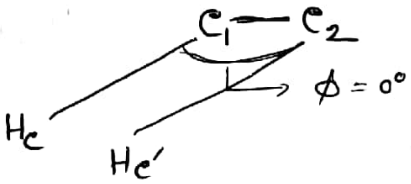
The bonds of C_1 i.e front carbon spread over from the centre of the ball. This is one of the form and this form has maximum energy and less stable because all the C–H bond pairs are parallel to each other C_1–Ha/C_2–Ha' angle = 0°

similarly, $C_1-H_b/C_2-H_{b'}$ and $C_1-H_c/C_2-H_{c'}$ angle are 0°.



$\phi = 0°$

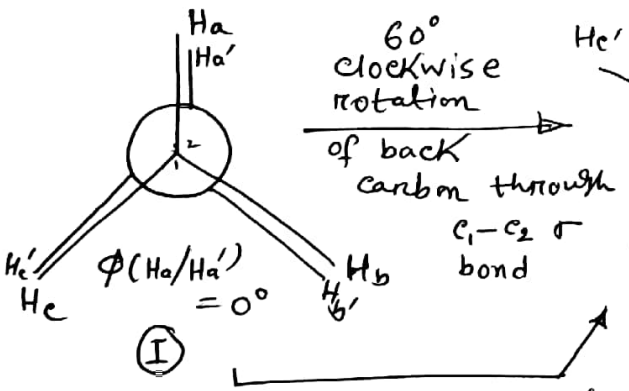




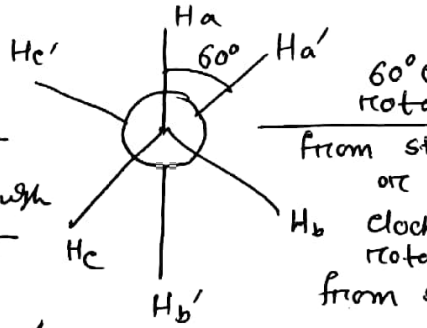
ϕ = dihedral angle.

$\phi = 0°$ i.e $\phi\ (H_b/H_{b'}) = 0°$

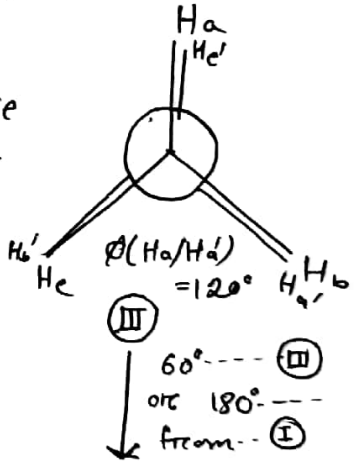
• if we rotate one carbon (eg back carbon) wrt another carbon joint through (C–C σ bond) suppose front carbon we will get innumerable (Gish-Sti) spatial arrangement or isomers But for the sake of identification a rotational frequency of 60° is maintained.



60° clockwise rotation of back carbon through C_1-C_2 σ bond



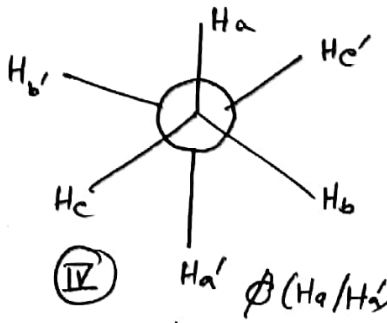
60° clockwise rotation from str. II or 120° clockwise rotation from str. I



60° ---- III or 180° --- from -- I

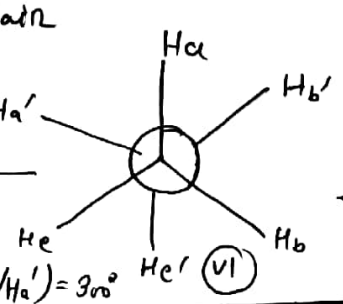
See here Ha/Ha' are 60° apart from each other, so str. II has less energy than str. I

str. I ⟶ Eclipsed (0°)
str. II ⟶ Gauche. (60°)



Specific pair ϕ (Ha/Ha')

60° ---- VI or 360° from I



60° ---- V or 300° --- VI

60° ---- (iv) or 240° --- (i)