

# Confirmations

*Alkanes contain carbon-carbon sigma ( $\sigma$ ) bonds. Electron distribution of the sigma molecular orbital is symmetrical which permits free rotation about C–C single bond. This rotation can change into one another. Such type of conversion into one another by rotation around a C-C single bond are called conformations or conformers or rotamers.*

*Alkanes have infinite number of conformations by rotation around C-C single bonds. It may be noted that rotation around a C-C single bond is not completely free. It is hindered by a small energy barrier of 1-20 kJ mol<sup>-1</sup> due to weak repulsive interaction between the adjacent bonds. Such a type of repulsive interaction is called **torsional strain**.*

*Ethane molecule ( $C_2H_6$ ) contains a carbon – carbon single bond with each carbon atom attached to three hydrogen atoms.*

*In this type of confirmation one carbon atom becomes stationary and rotate the other carbon atom around the C-C axis. This rotation gives infinite number of spatial arrangements of hydrogen atoms attached to one carbon atom with respect to the hydrogen atoms attached to the other carbon atom. These are called **conformational isomers** (conformers).*

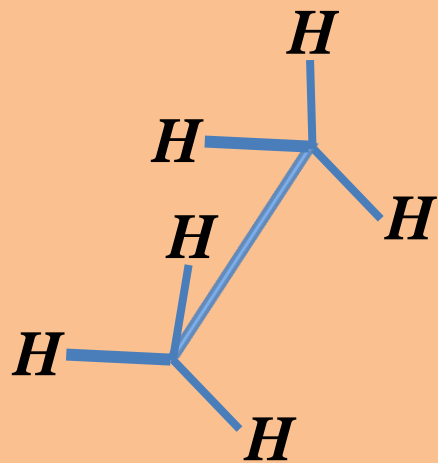
*There are two conformations , eclipsed and staggered. One conformation in which hydrogen atoms are attached to the two carbons are closed together as possible is called **eclipsed** conformation and the other in which hydrogens are far apart as possible is known as the **staggered** conformation.*

*Any other intermediate conformation is called a **skew** conformation. It may be noted that in all the conformations, the bond angles and the bond lengths remain the same. The conformations can be represented by **Sawhorse** and **Newman projections**.*

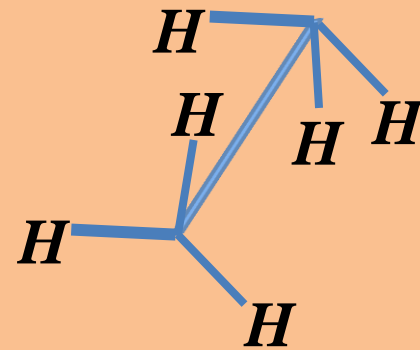
# *Sawhorse projections*

*In this projection, the molecule is projected on paper by drawing the central C–C bond as a somewhat longer straight line. Upper end of the line is slightly tilted towards right or left hand side. The front carbon is shown at the lower end of the line, while the rear carbon is shown at the upper end. Each carbon is attached to three hydrogen atoms.*

*The lines are present at an angle of  $120^\circ$  to each other. Sawhorse projections of eclipsed and staggered conformations of ethane are shown as -*



*eclipsed*



*staggered*