

Q22. Rotation around carbon-carbon single bond of ethane is not completely free. Justify the statement.

Sol: Ethane contains carbon-carbon sigma (σ) bond. Electron distribution of the sigma molecular orbital is symmetrical around the internuclear axis of the C – C bond which is not disturbed due to rotation about its axis. This permits free rotation around a C-C single bond. However, rotation around a C – C single bond is not completely free. It is hindered by a small energy barrier due to weak repulsive interaction between the adjacent bonds. Such a type of repulsive interaction is called torsional strain. Of all the conformations of ethane, the staggered form has the least torsional strain and the eclipsed form has the maximum torsional strain. The energy difference between the two extreme forms is of the order of 12.5 kJ mol^{-1} , which is very small. It has not been possible to separate and isolate different conformational isomers of ethane.