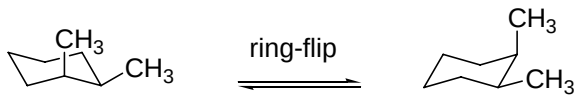
Cis-1,2-disubstituted cyclohexane

One group axial and another equatorial in both ring-flip chair conformations. If the two groups are of the same size or identical then both chair conformations are of equal stability. The two chair conformations then are under equilibrium. On the other hand, if the two groups are not of the same size (bulk), the more stable conformation is the one in which the larger (bulkier) group is on the equatorial position. The reason is to avoid the relatively more (worse) steric strain caused by 1,3-diaxial interactions which will be present in the conformation in the chair in which the bulkier group is in the axial position.

Example: cis-1,2-dimethylcyclohexane



one methyl axial
one methyl equatorial

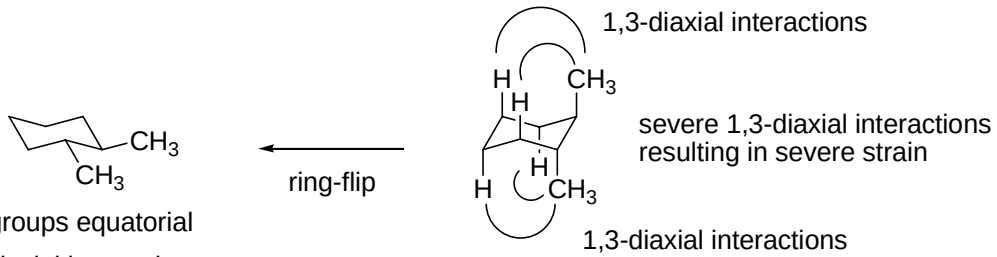
one methyl axial
one methyl equatorial

***Question**:* Draw two chair conformations of cis-1-*t*-butyl-2-methylcyclohexane. Determine which is more stable and why?

Trans-1,2-disubstituted cyclohexane

Both groups are axial in one chair and they are both equatorial in the other chair conformation. Because of severe 1,3-dixial interactions (double CH_3-H) in the chair in which the two groups are both axial, this chair conformation results in very high instability. The chair in which both are equatorial are far more stable.

Example: trans-1,2-dimethylcyclohexane



both groups equatorial
no 1,3-diaxial interactions

both groups axial

far more stable

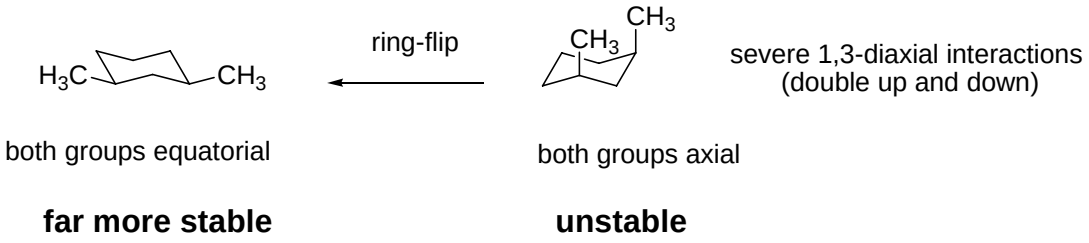
unstable

***Question**:* Draw two chair conformations of trans-1,2-diethylcyclohexane. Determine which is more stable and why?

Cis-1,3-disubstituted cyclohexane

Both groups are axial in one chair conformation and both are equatorial in the other. Clearly and due to high strain cause by severe 1,3-diaxial interactions in the chair in which both groups are axial, the other chair in which both are equatorial are far more stable.

Example: cis-1,3-dimethylcyclohexane

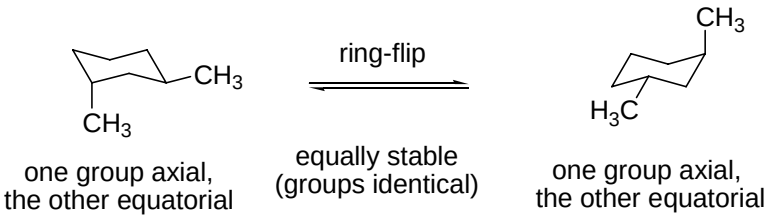


***Question**:* Draw two chair conformations of cis-1,3-diethylcyclohexane. Determine which is more stable and why?

Trans-1,3-disubstituted cycleohexane

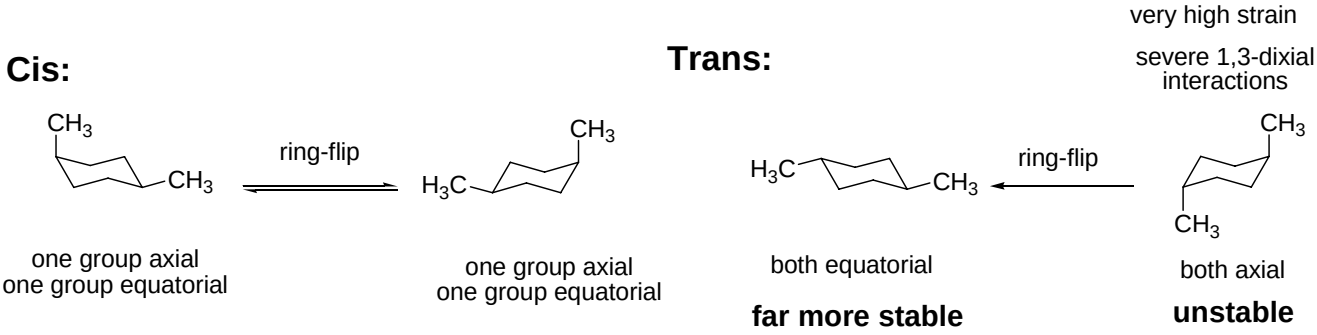
One group axial and the other is equatorial in both chair conformations. If the two groups are of the same size (bulk) or identical, the two chair conformations are equally stable and the molecule is under equilibrium between the two. If the two groups are not of the same size, then the chair in which the bulkier group is in the equatorial position is the more stable. The reason is the relatively worse 1,3-diaxial interactions which will be present in the chair in which the bulkier group in the axial position.

Example: trans-1,3-dimethylcyclohexane



***Question**:* Draw two chair conformations of trans-1-isopropyl-3-methylcyclohexane. Determine which is more stable and why?

1,4-disubstituted cyclohexane



***Question**:* Draw two chair conformations of cis-1-*t*-butyl-4-methylcyclohexane. Determine which is more stable and why? Do the same for trans-1,4-diisopropylcyclohexane.