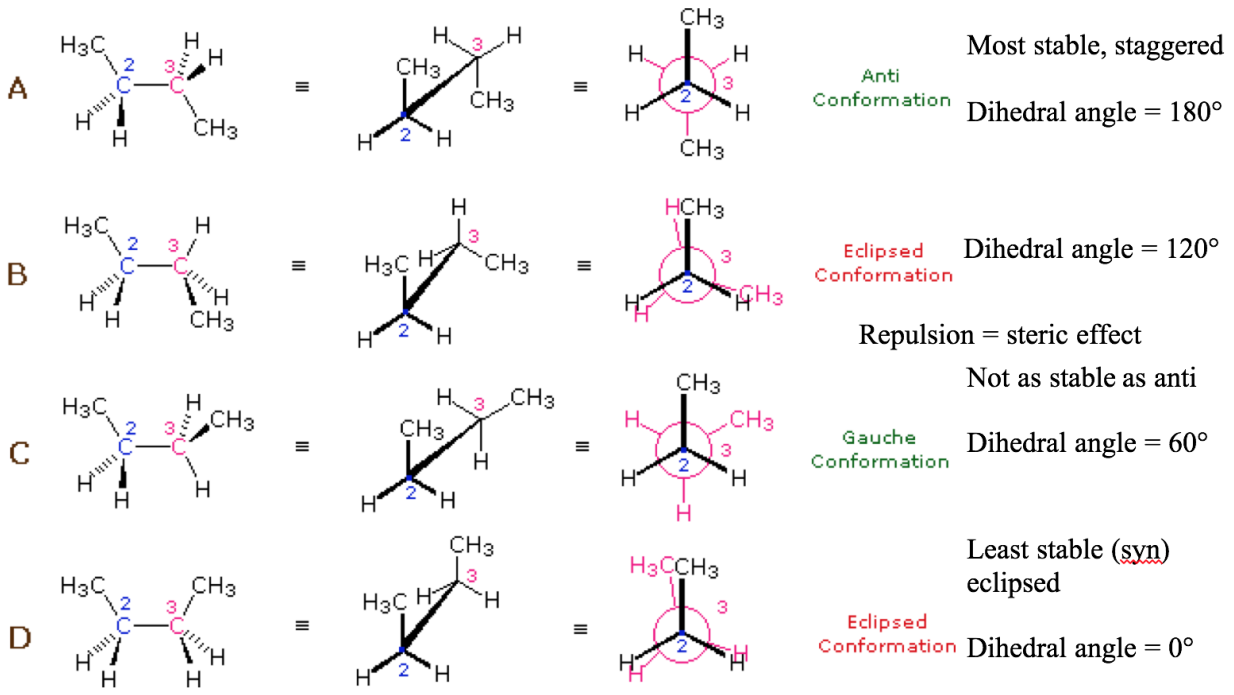
CHEM 261 Notes Winter 2026 Feb 5, 2026

Recall: A molecular conformation is any spatial arrangement of atoms that can be interconverted by rotation about single bonds of the molecule.

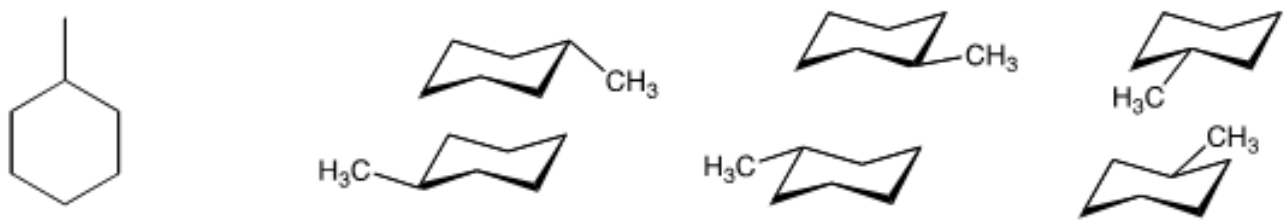
Rotation around all bonds still very rapid.
Most stable (most populated conformation) is called anti and has groups as far away as possible.
Note: Newman Projection allows you to look at only one bond at a time. In the case of n-butane, we are looking through the central bond.



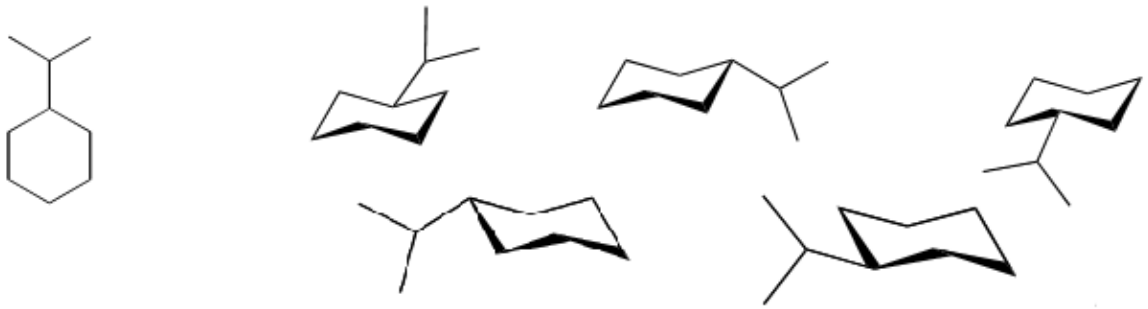
Cyclohexane molecules usually prefer to exist as chair conformations. Steric strain drives the lowest energy conformation.

Examples of Most Stable Conformation of Substituted Cyclohexanes :

1. Methylcyclohexane
   – 6 drawings of same molecule



2. Isopropylcyclohexane

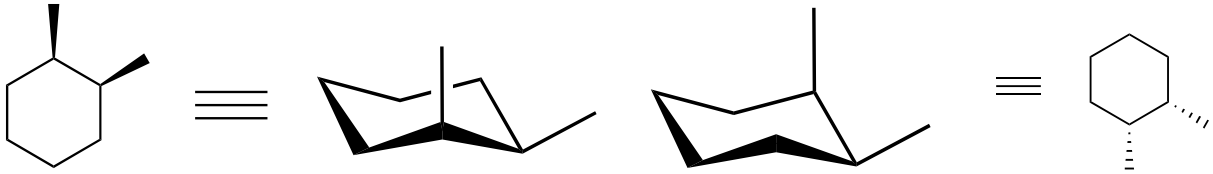


For most stable conformation, largest group at equatorial position

Examples of Most Stable Conformation of Polysubstituted cyclohexanes:

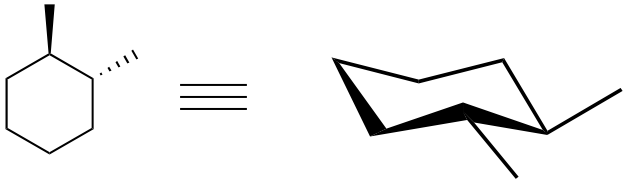
Examples:

1A) *cis*-1,2-dimethylcyclohexane



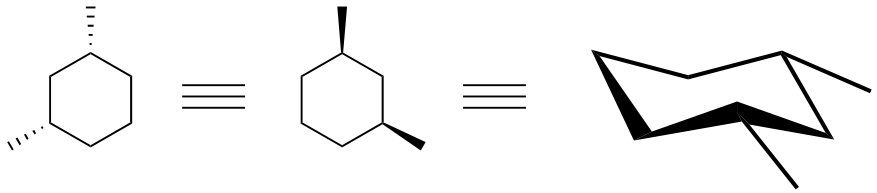
- One methyl group axial and one methyl group equatorial

1B) *trans*-1,2-dimethylcyclohexane (a stereoisomer (diastereomer) of above structures)



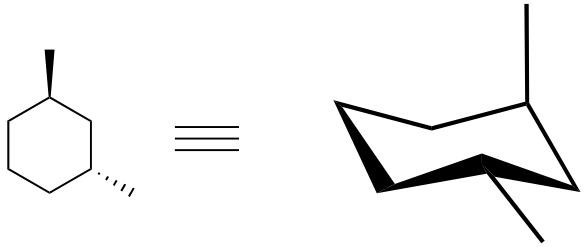
- Both methyl groups equatorial

2A) *cis*-1,3-dimethylcyclohexane (a structural isomer of above structures)



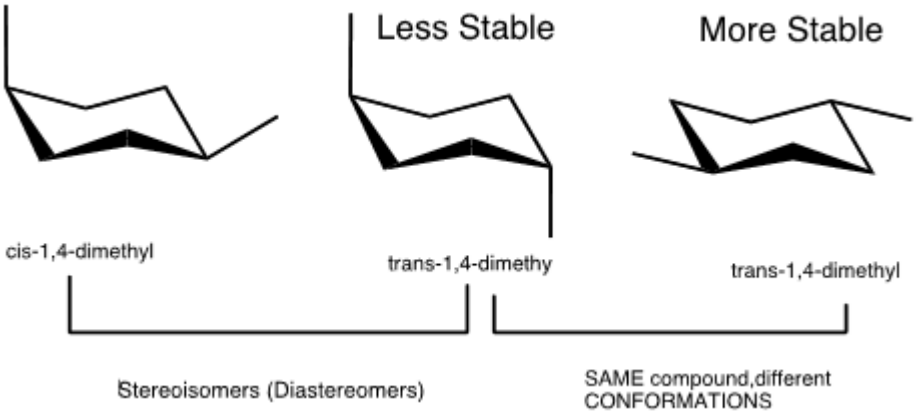
- Both methyl groups equatorial

2B) *trans*-1,3-dimethylcyclohexane: a stereoisomer of above *cis*-1,3-dimethylcyclohexane

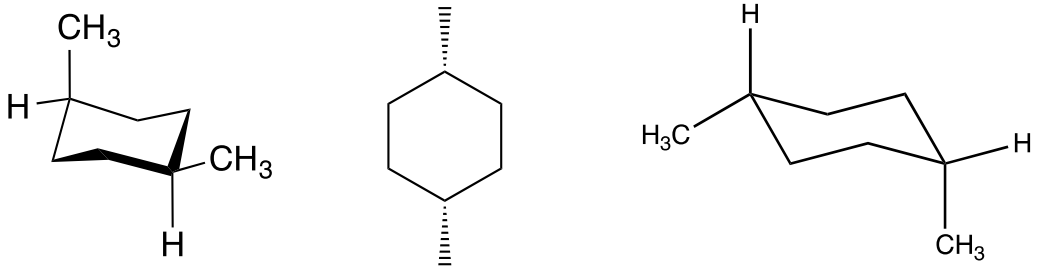


- One methyl group axial and one methyl group equatorial

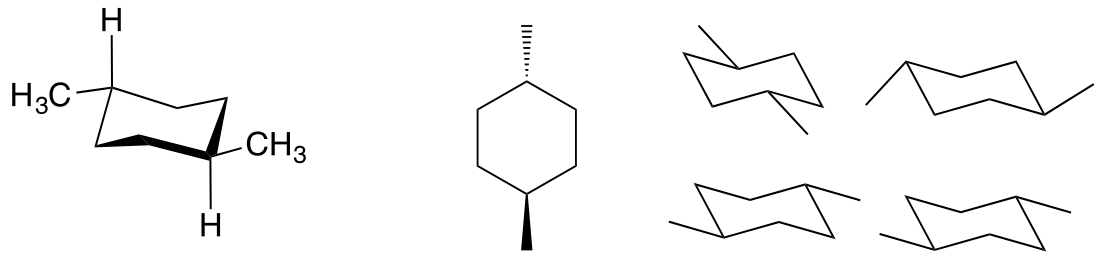
3A) cis-1,4-dimethylcyclohexane and trans-1,4-dimethylcyclohexane:



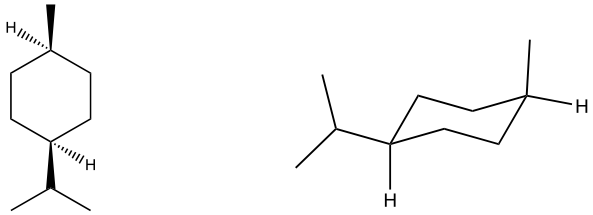
cis-1,4-dimethylcyclohexane:



3B) *trans*-1,4-dimethylcyclohexane:



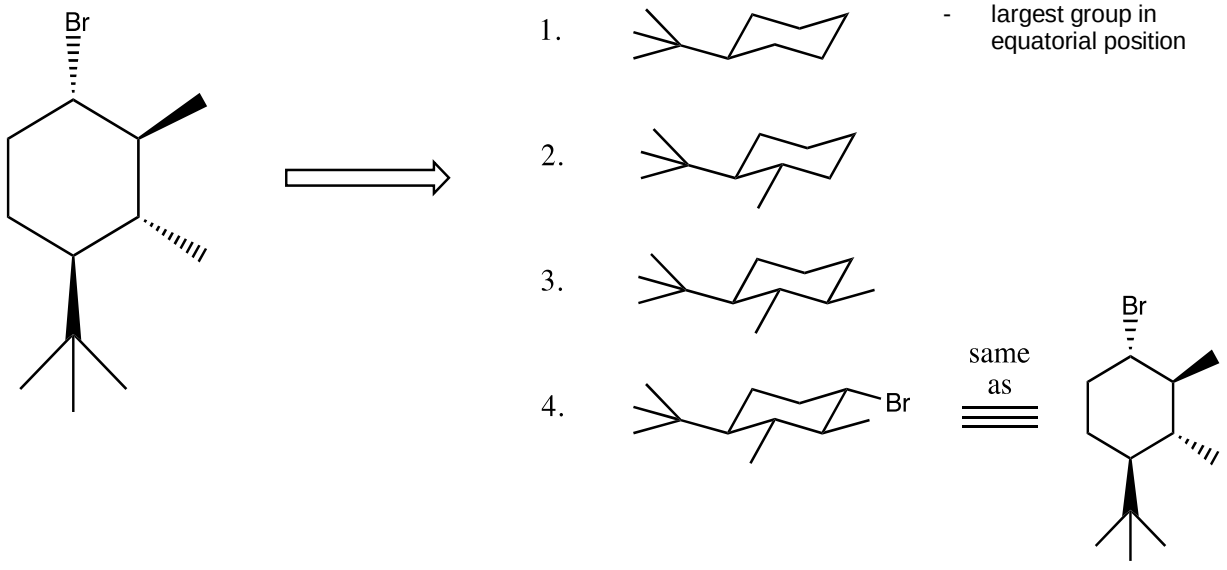
Application example: *cis*-1-isopropyl-4-methylcyclohexane



most stable conformation (bulky isopropyl group is in the equatorial position)

How to draw the most stable conformation of substituted cyclohexanes:

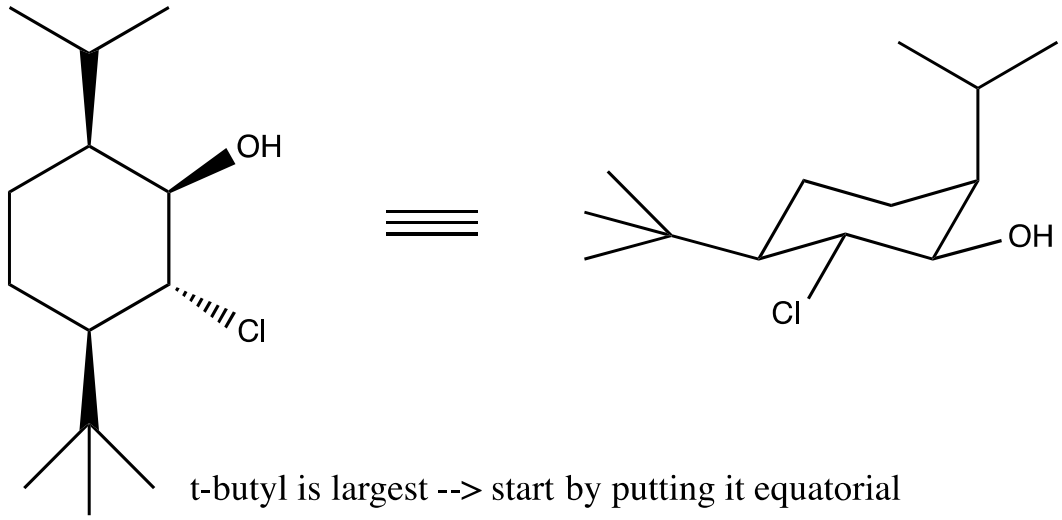
1. Start by drawing the chair conformation of cyclohexane
   Put the largest group in an equatorial position
2. Draw the next group(s) on the correct atom(s) with respect to the largest group in correct geometry



- largest group in equatorial position

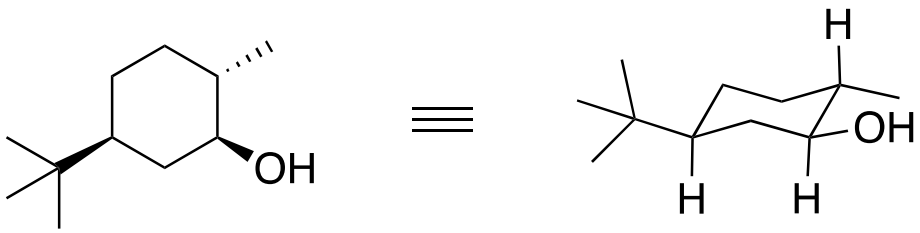
Note that the **largest substituent** (tertiary butyl) is placed in the **equatorial** position to **avoid** destabilizing **1,3-diaxial interactions**

Another example:



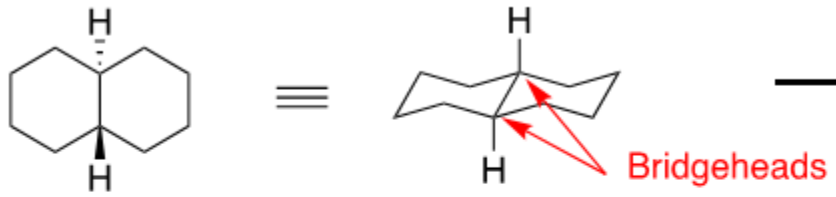
t-butyl is largest --> start by putting it equatorial

More example:

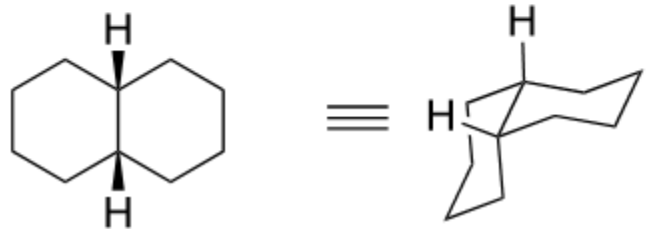


Bicyclic structures

Trans-decalin (4.4.0 bicyclodecane)

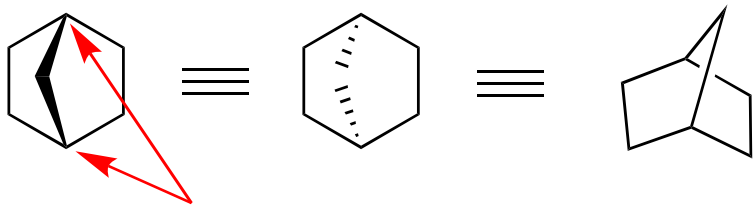


Cis-decalin (4.4.0 bicyclodecane)



diastereomers
(NOT conformational isomers)

Norbornane (2.2.1 bicycloheptane)



Steroids: