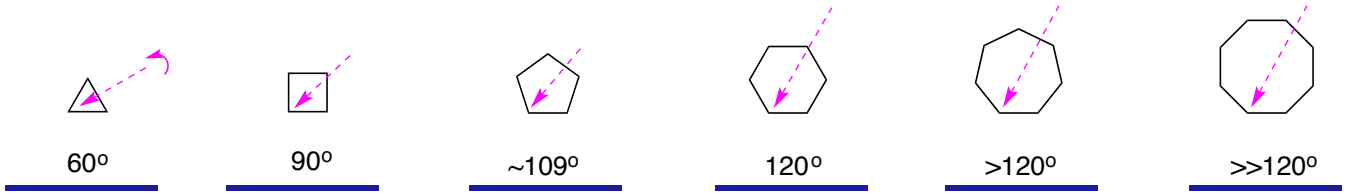
Conformations Of Cyclic Hydrocarbons

from chapter(s) _____ in the recommended text

A. Introduction

B. Angle Strain



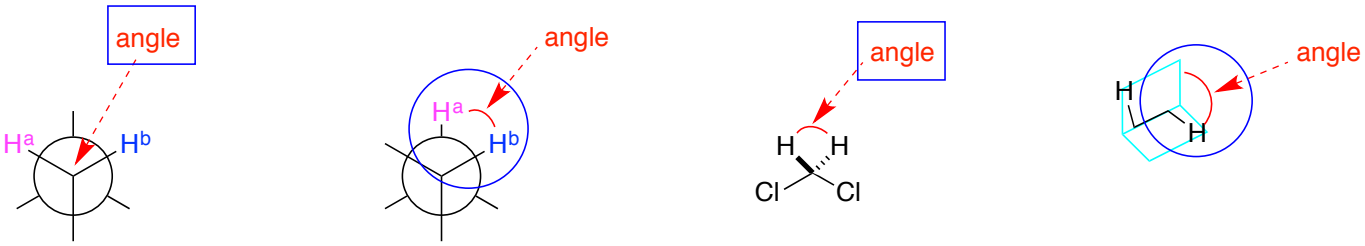
is around *109°*.
has *angle* strain.

: *cyclopropane / cyclobutane*.

cyclohexane / cycloheptane / cyclooctane.

most compressed and expanded angles are: *cyclopropane and cyclooctane*.

C. Bond Strain

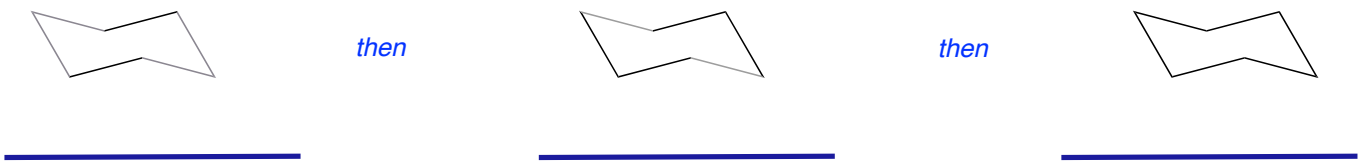


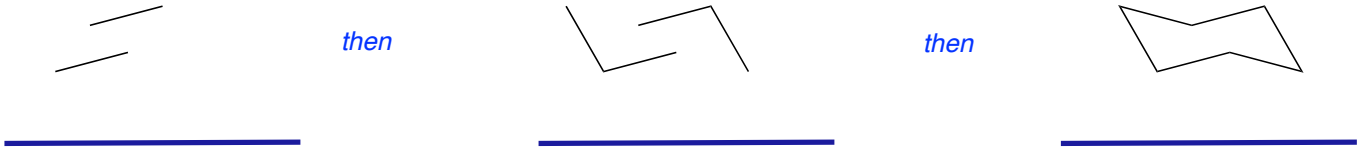
3 atoms, whereas torsional angles involve *4*.
e⁻ in bonds and is *minimized* as

high *torsional* strain.

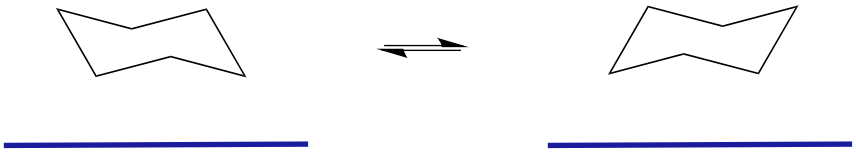
D. Cyclohexane

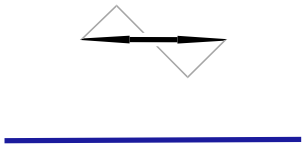
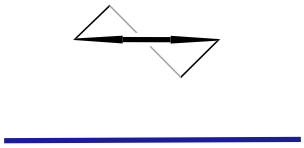
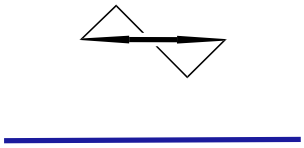
have *less* angle strain because the internal angle is *closer to* the ideal sp^3 angle.
to *torsional* strain.

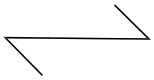
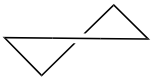




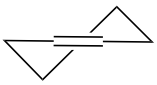
have *exactly the same* energies.

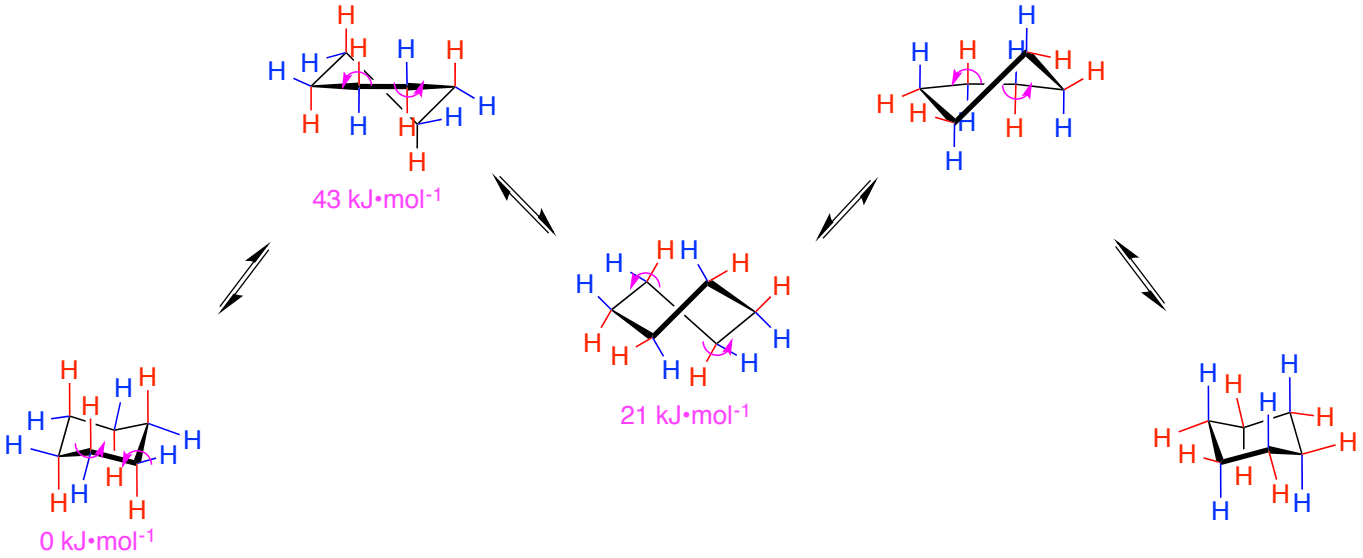


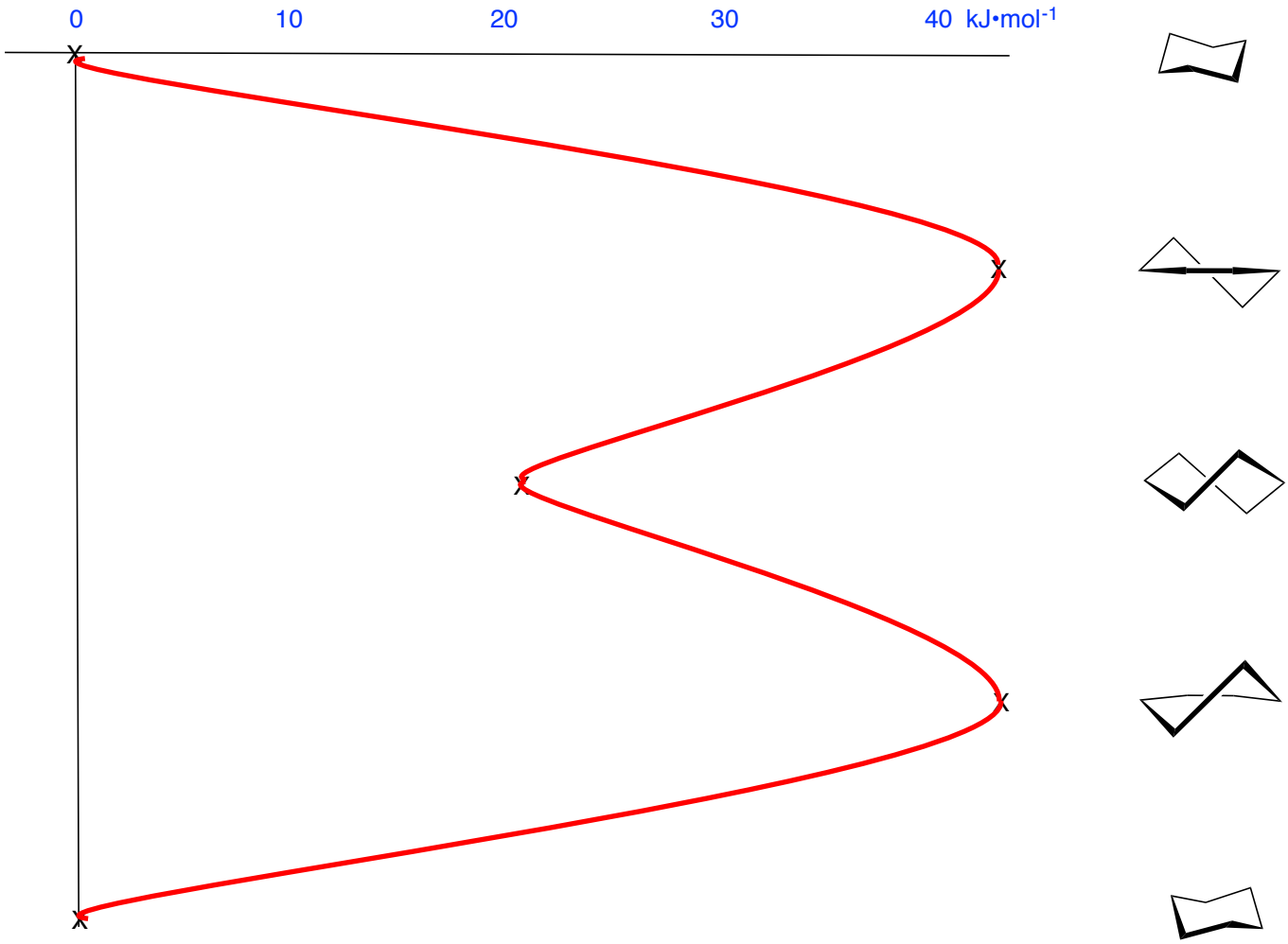

then

then


then

then


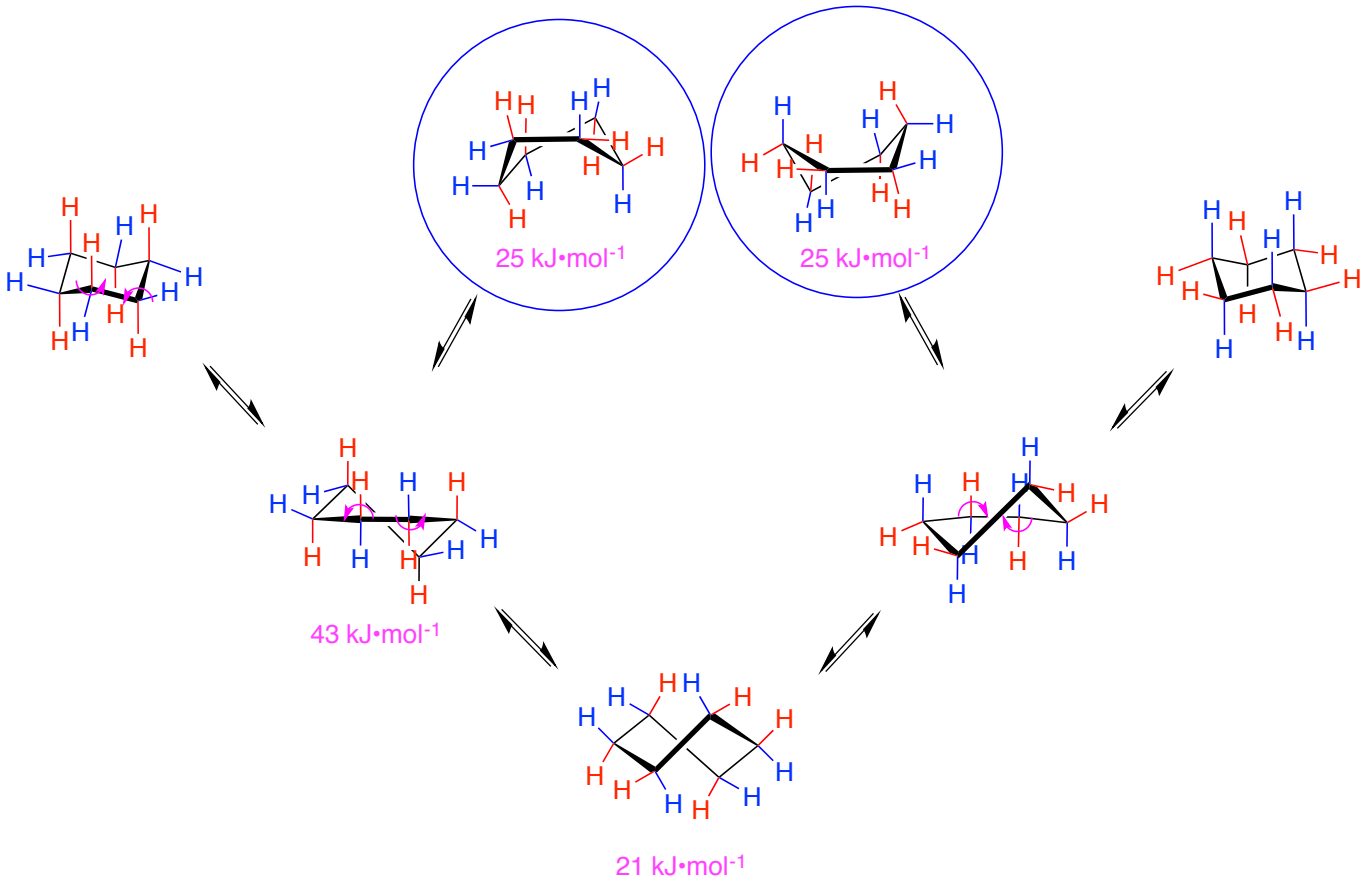
Cyclohexene



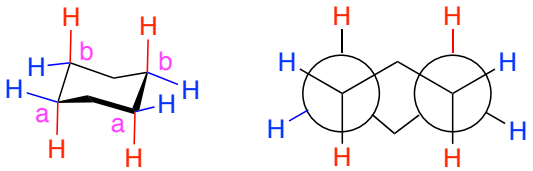

43 kJ•mol-1
21 kJ•mol-1
0 kJ•mol-1

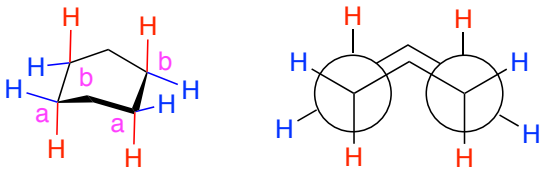

0
10
20
30
40 kJ•mol-1

Boat conformers *are not necessarily*



are *three* dimensional.

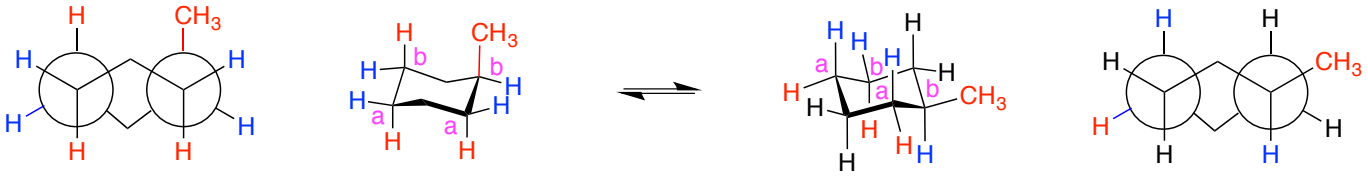




like the *antiperiplanar* conformation of butane,

gauche conformer.

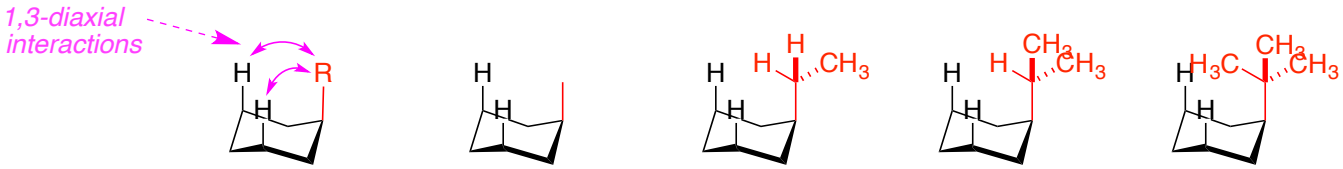
Monosubstituted Cyclohexanes



less stable

more stable

has *1* gauche interaction,
0 such interactions



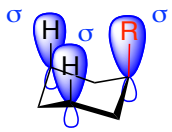
because _____ 1,3-diaxial interactions between the axial hydrogen atoms and the tert-butyl group is higher than others, because of the extra methyl.

equatorial conformer is observed.

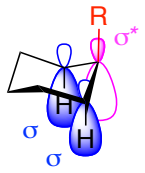
NMR *does not*

1,000 times per second.

lower σ- and σ*-orbitals

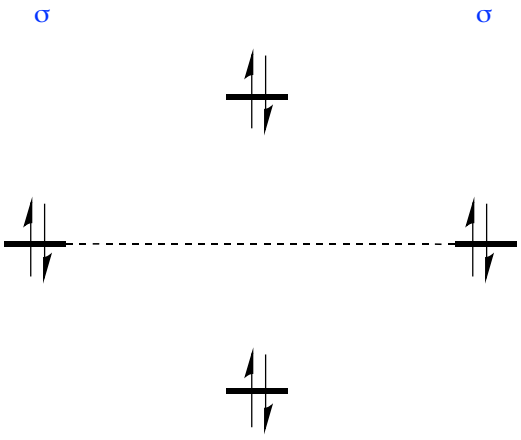


repulsive

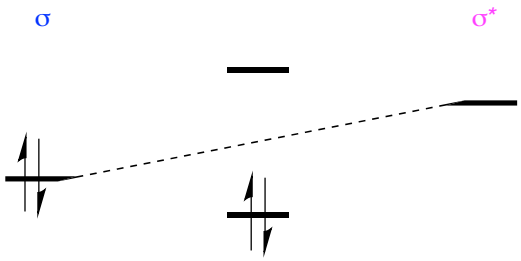


attractive

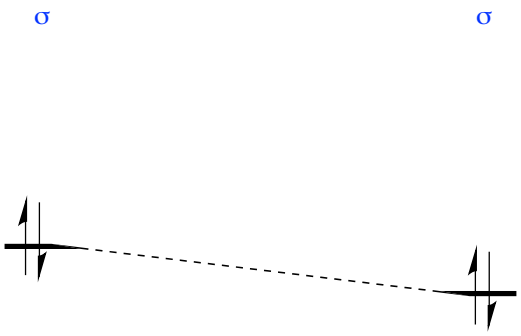
R = Me



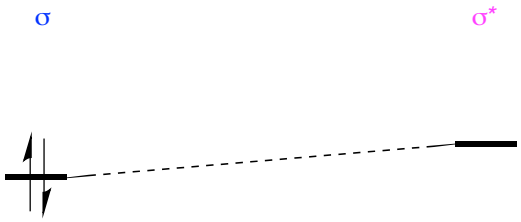
R = Me



R = OMe



R = OMe



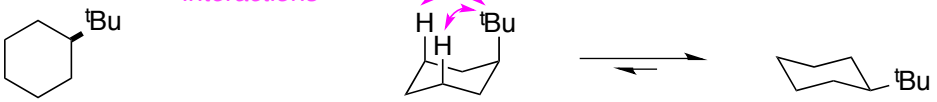
involve *less* overlap than the corresponding σ-to-σ 1,3-interactions, and, based on the orbital energy levels, the 1,2-interaction for the σ-to-σ* is *less* R = Me than it is for R = OMe.

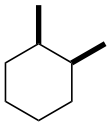
because _____ *C – O* bonds have lower σ- and σ*-orbitals, stabilizing σ-to-σ* interaction.

Disubstituted Cyclohexanes

example

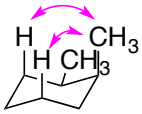
two 1,3-diaxial interactions



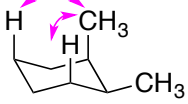


how many 1,3-diaxial interactions?

two

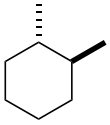


equilibrium position

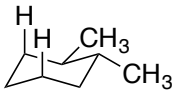


how many 1,3-diaxial interactions?

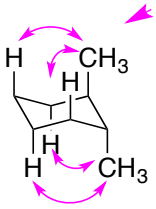
two

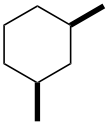


no 1,3-diaxial interaction

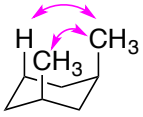


four 1,3-diaxial interactions

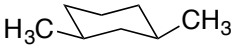


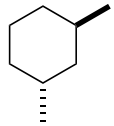


two 1,3-diaxial interactions

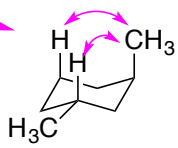


no 1,3-diaxial interaction

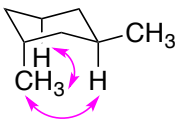


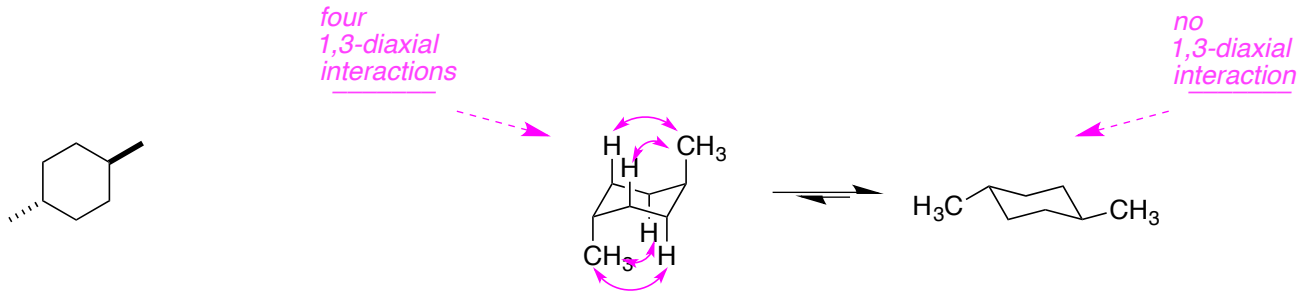


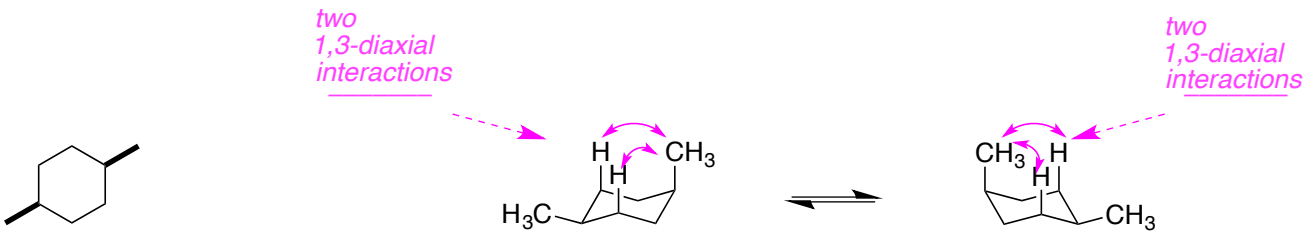
two 1,3-diaxial interactions



two 1,3-diaxial interactions

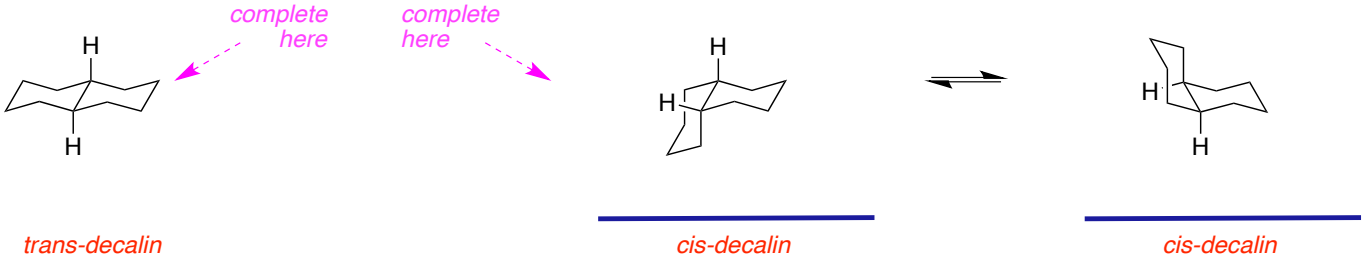


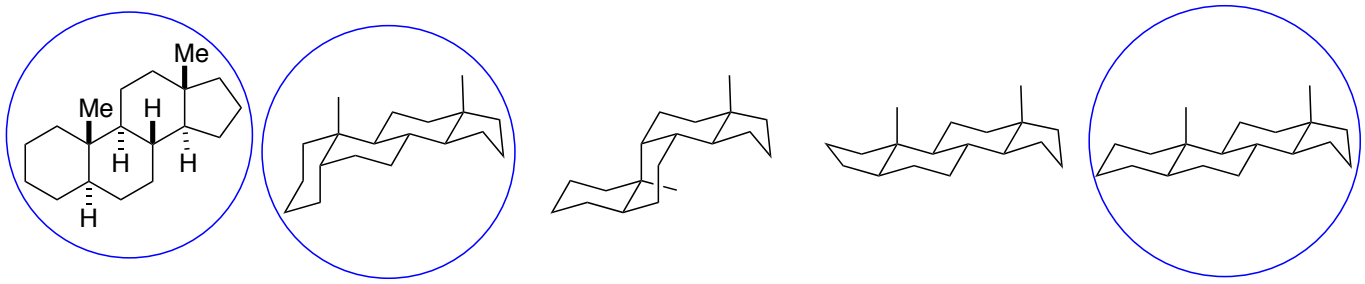




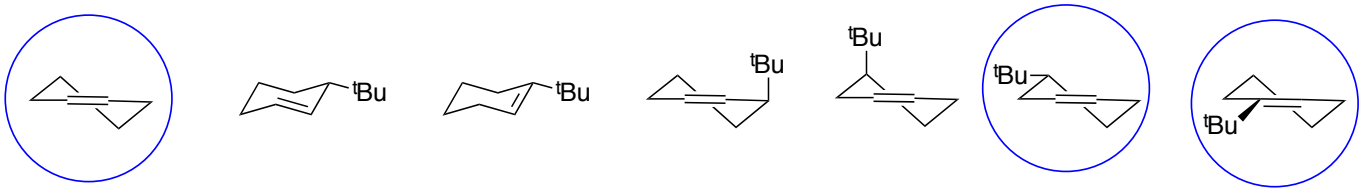
Decalins

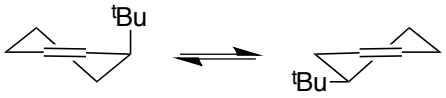
a bond; look up the structure in Wiki.

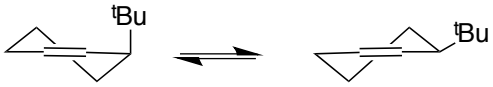


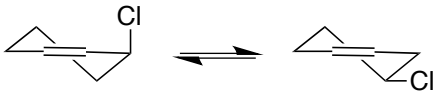


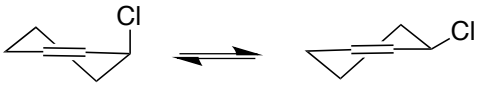
Cyclohexenes

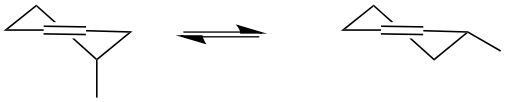


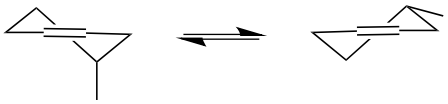




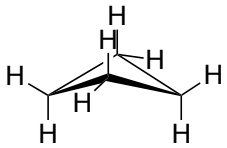




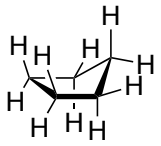




E. Other Rings



cyclobutane



cyclopentane

do rapidly interchange (on the NMR time-scale)
are *rigid and flat*.
eclipsed