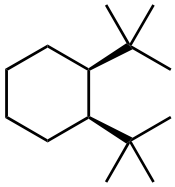
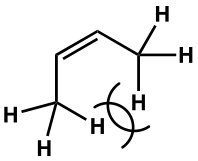
Identifying Types of Strain

What types of strain will the following molecules possess? Provide a brief explanation for your answers.

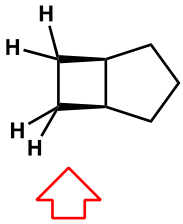


Steric strain. The two *tert*-butyl groups, on the same face of the cyclohexane, clash with each other

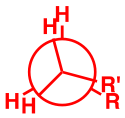
Angle strain and torsional strain. Cyclopropane bond angles (60°) are much lower than ideal 109.5° for tetrahedral and 120° for trigonal planar



Steric strain. Hydrogens on the two methyl groups clash with each other.

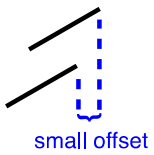


Angle strain, torsional strain. Angles in the cyclobutane are 90°, which is less than ideal, and the indicated hydrogens are forced to be eclipsed, affording some torsional strain.

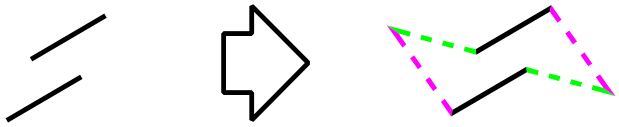


Guide to Drawing Chair Conformations

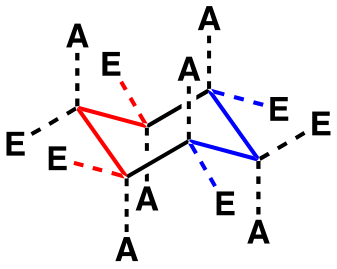
First, draw two parallel lines with a small horizontal offset, as shown. The offset allows you to fill in the axial substituents without overlapping with the other carbons in the ring.



Next, draw bonds to the other two carbons, one going up, the other down.
The green bonds shown below should be parallel, and the magenta bonds should be parallel with each other.

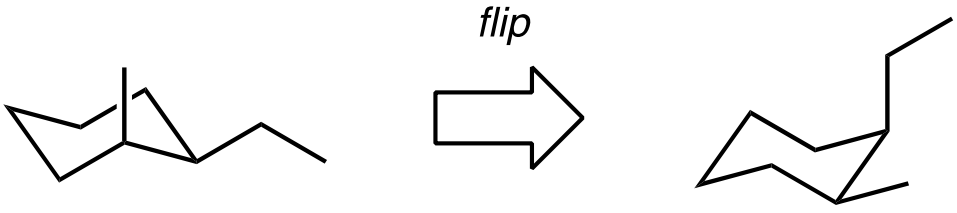


Axial and equatorial substituents are filled in as shown. Take note of which lines are parallel.



E = equatorial substituent
A = axial substituent

When the chair flips, the cyclohexane should be "pointing" in the opposite direction. All axial substituents become equatorial, and all equatorial become axial.



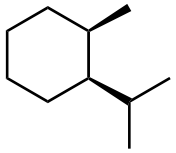
Notice that both substituents are pointed <u>up</u> in both conformations.

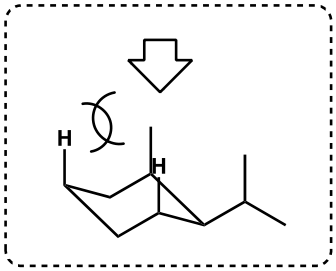
Chair Conformation Practice

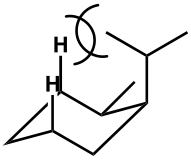
Draw the two possible chair conformations which can be formed for each of the following molecules. Circle the chair which has the lowest energy, and give a short explanation.

Next, provide the enantiomer for each molecule, or write "not chiral".

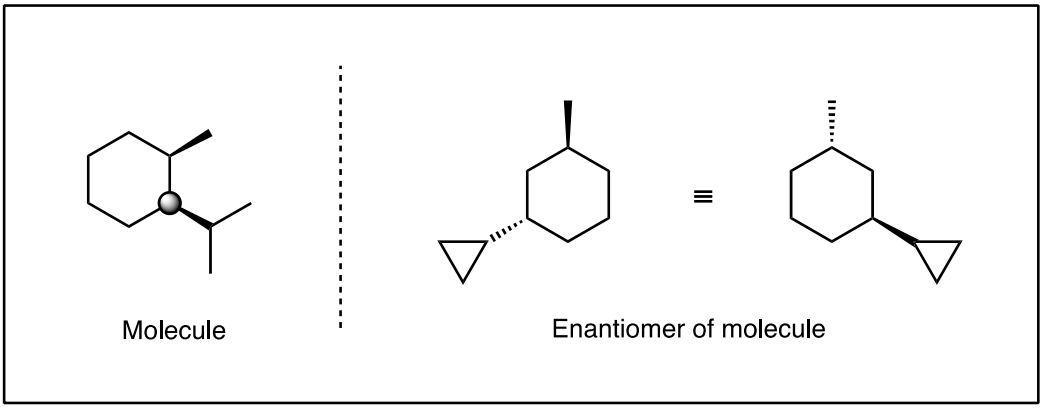
looking from top

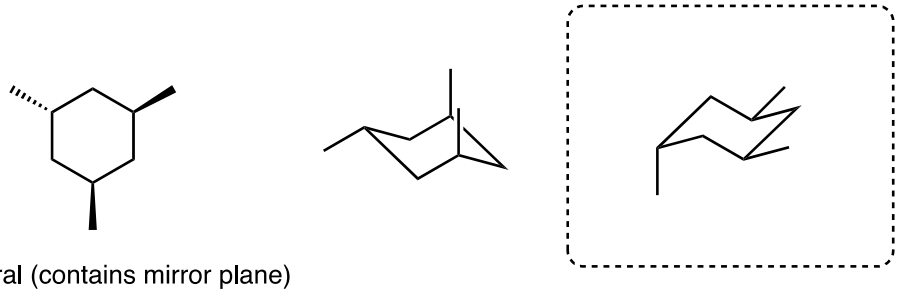






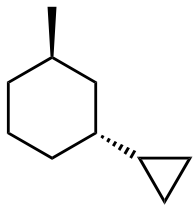
The isopropyl group prefers to be in the equatorial position, as it causes more steric strain than the conformation with axial methyl.

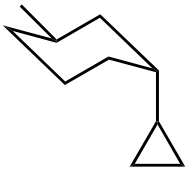


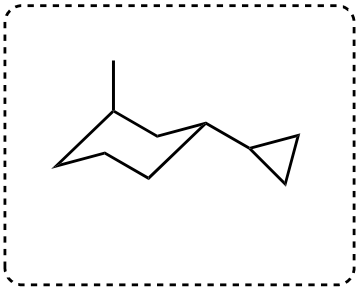


Not chiral (contains mirror plane)

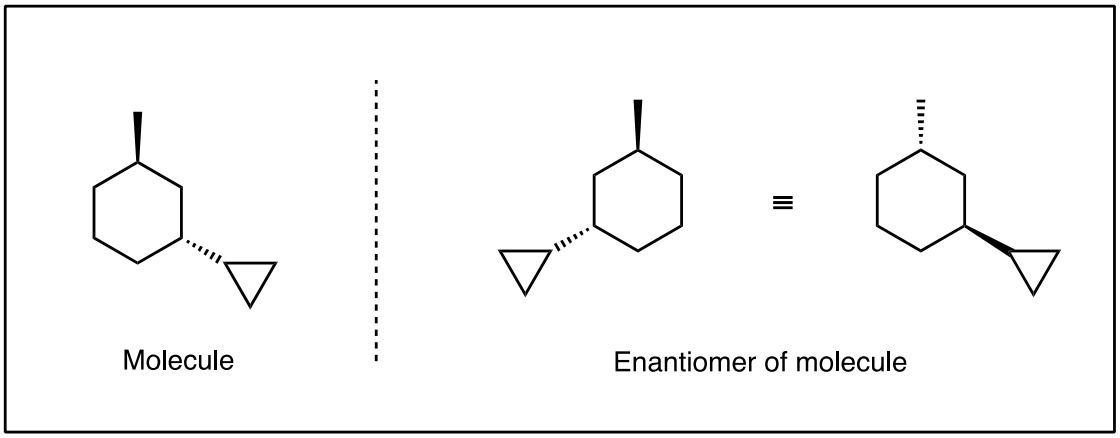
Putting a single methyl axial is better than putting two axial.

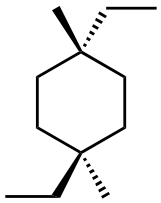


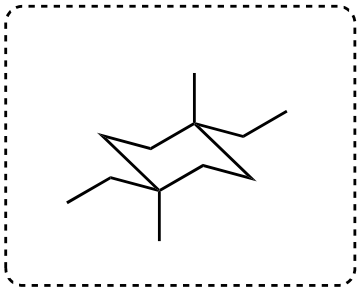


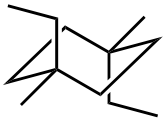


Cyclopropyl is bulkier than methyl.









Not chiral (contains mirror plane)

Placing the ethyl groups equatorial is preferred.

Newman Projection Practice

Practice drawing Newman projections for the following, when looking in the direction of the arrow.

Is that the lowest energy conformation? If not, rotate the bond to achieve this conformation, and provide the Newman projection.