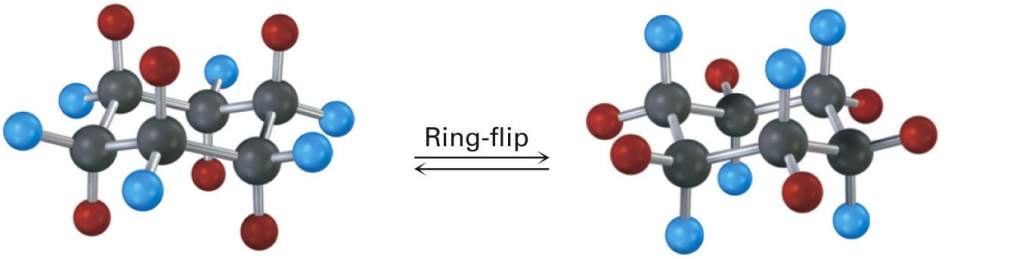
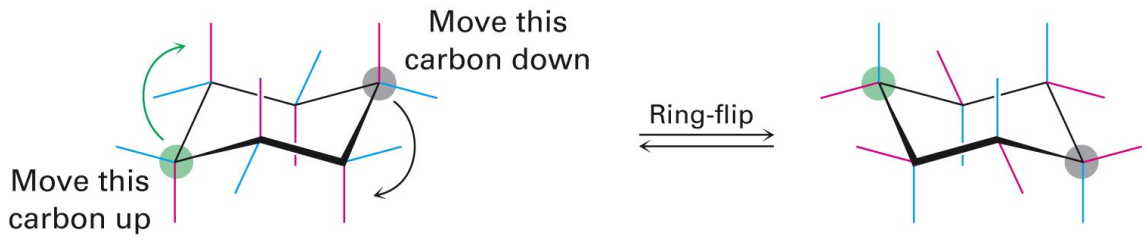
CHAPTER 4: CYCLOALKANES (cont.)

In the space below, practice drawing cyclohexane in a chair conformation (yes, please do it again).

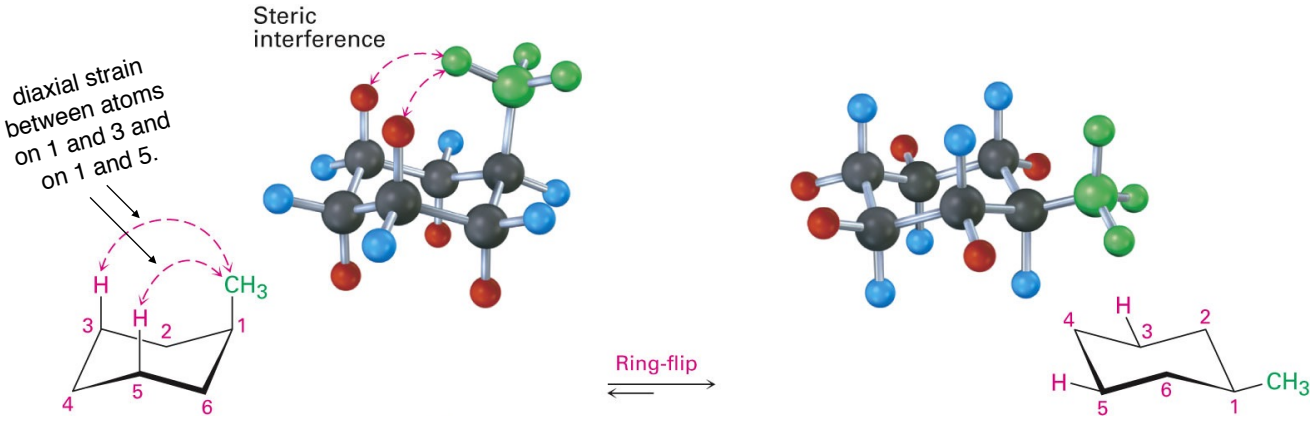
At room temperature, chairs can ring flip. Notice all the vertical bonds to atoms on the left chair (called axial positions) after the ring flip are now located around the 'perimeter' of the chair (called equatorial positions). When a ring flips, all axial atoms become equatorial and all equatorial atoms become axial. Try this using your model kit.



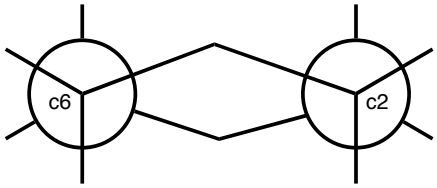


Now you try - draw the ring flip as shown above (the one on the right)?

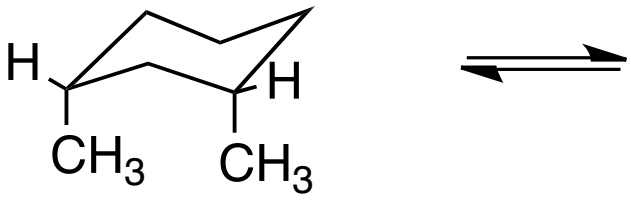
As a rule of thumb, when a cyclohexane ring has one or more substituents on it, the largest group will prefer to be equatorial (right structure) rather than axial (left structure). The two 1,3-diaxial interactions (steric strain) you see on the left structure each costs 3.8 kJ/mol - so what's the total diaxial strain of the structure on the left? _____



Here's a blank Newman projection of the upper left molecule. Sighting down the c6-c5 and c2-c3 bonds, add hydrogens and the CH_3 group and show the 1,3-diaxial interactions:



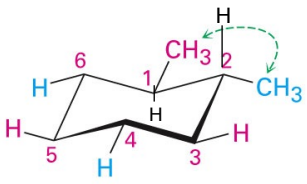
Can you identify the diaxial interactions on the structure of cis-1,3-dimethylcyclohexane? Hint: there are three interactions, and they are not both between a CH_3 and a H. Try drawing a ring flip of this molecule. Do those interactions change?

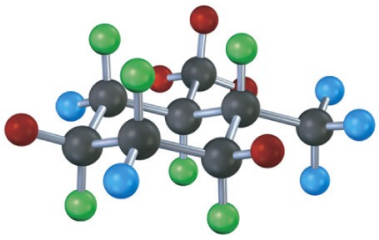


A trans-1,2-disubstituted cyclohexane can exist in two chair forms - when both groups are equatorial (below), notice the 60 degree dihedral angle between the two groups? This is a gauche interaction that creates 3.8 kJ/mol of strain energy.

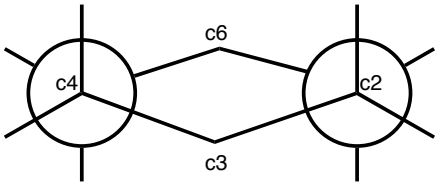
***trans*-1,2-Dimethylcyclohexane**

One gauche interaction (3.8 kJ/mol)





Complete the Newman projection of this ring (shown below), sighting down the c4-c5 and c2-c1 bonds. Add hydrogens and the CH_3 groups - you should find a CH_3-CH_3 gauche interaction:



Here's the same ring again. Draw a ring flip of this molecule. Is one more stable than the other?