Alkanes #4: Up Close And Personal With Cyclohexane

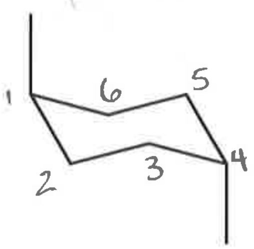
As we discussed in the video lesson, 6-membered rings are found all throughout nature due to their superb stability (no ring strain, remember?). 6-membered rings don't solely exist on their own: They have substituent groups on them. So much like the energy analysis we did for Newman Projections, we are going to look at several instances of cyclohexane rings (with substituent groups on them), and compare the various energy conformations based on how the groups are spatially arranged.

That was a lot of words: Basically we are going to draw low and high energy conformations of various cyclohexane molecules that have groups attached. It's easy—I promise.

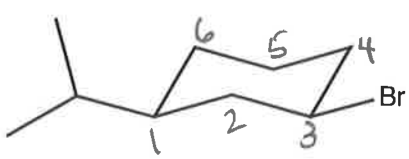
Up = wedge   Down = dash

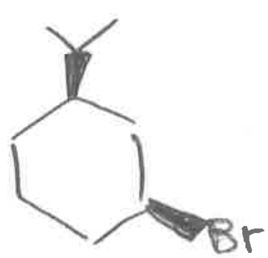
1.) Given the chair form of cyclohexane, convert the structure to the flat, bond-line structure we typically use to draw organic molecules.

i.)



ii.)





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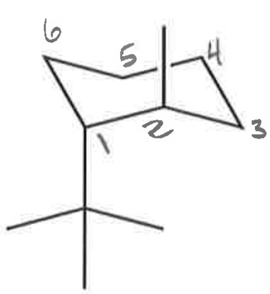
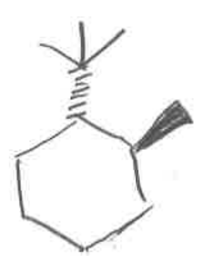
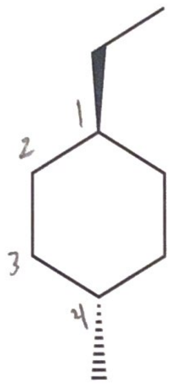


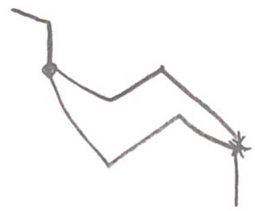


2.) Okay, good job. Now let's switch it up: I'm going to give you the flat, cyclohexane structure, and you have to draw BOTH cyclohexane chair conformations. In other words, draw one chair form, and then flip the chair and achieve the other conformation.

Chair 1 | Chair 2

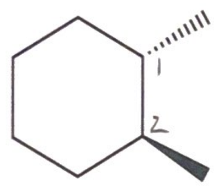
i.)

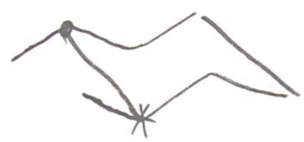




Chair 1 | Chair 2

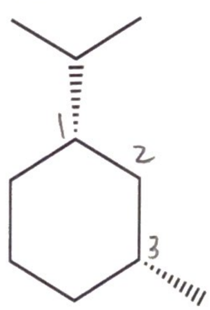
ii.)





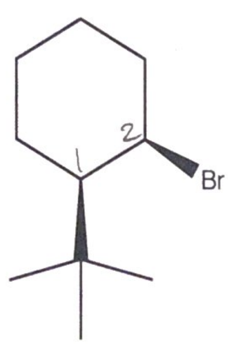
Chair 1 | Chair 2

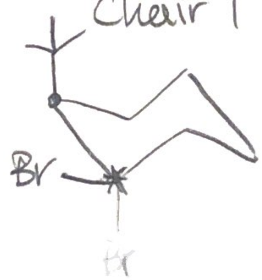
iii.)



Chair 1 | Chair 2

iv.)

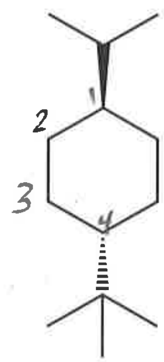


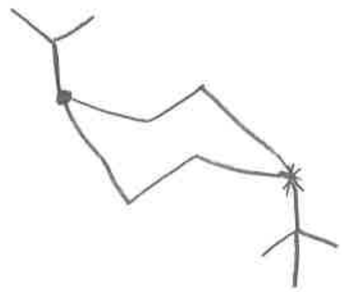


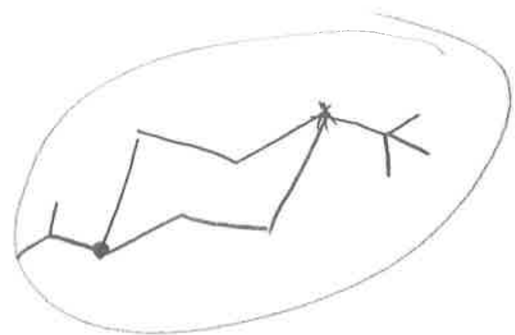
Sorry—I know that was a little overkill. This skill ***never*** goes away, so it pays to nail it down sooner rather than have to relearn it later.

3.) Here is the last set of problems for this worksheet. I will provide a flat, disubstituted cyclohexane structure. Your job is to convert it to chair form, "flip" the chair to obtain the other chair conformation, and circle the lowest energy conformation between the 2 structures.

i.)

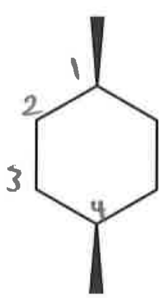


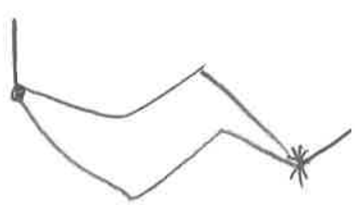




Both groups equitorial

ii.)





They are equivalent in stability/energy

CHALLENGE—Okay gang, we didn't explicitly cover this in the cyclohexane video, but since you're organic rockstars I know you got this.

Take the chair below and convert it to a Newman Projection: