Constructing and Manipulating a Physical Model of Cyclohexane

Transcript

Instructor: Brett McCollum

00:00:00:00 - 00:00:38:51
Instructor: The purpose of this video is to help you get practice drawing cyclohexane and other molecules derived from it using the chair conformation representation. To do this, first, we want to draw a pair of parallel lines on a slight slant. You can see I've got them aligned vertically this way. Now, I'm going to join them by drawing another set of parallel lines like this, and finally, a third set of parallel lines, forming my chair conformation. Here in the middle, we have the seat.

00:00:38:51 - 00:01:08:67
Instructor: We have the head rest, and we have the footrest of our chair conformation. Now, if the molecule that we're assigned to draw is trans one ethyl, three methyl, cyclohexane, we need to recognize that we have to choose where position one is going to be for that ethyl group. Now, what we can do is choose anywhere we like. I've decided to put my ethyl group. How about right here?

00:01:08:67 - 00:01:33:51
Instructor: I'll make this position one. Then for position three, I could either go two, three or two, three. Either of those is going to be acceptable. I'm going to put my position three right here. We take our ethyl group and we can draw it in either the axial position or the equatorial position.

00:01:33:51 - 00:02:06:28
Instructor: I'm going to put it in the equatorial to start. How we're going to draw the ethyl group at this position is by recognizing, we've got two bonds forming the vertex that represents the carbon atom there. Look for the other set of parallel lines. That's what you're going to draw your equatorial position aligned with. So, if I've already used these set of lines, the other set that's parallel that I haven't used is this set right here.

00:02:06:28 - 00:02:42:53
Instructor: So, I'm going to draw a bond parallel with those lines, and I need it to be two carbons long to be an ethyl group. There we go, we've got our ethyl group at position one, and I've put it in an equatorial position. We recognize at that position, it is equatorial pointing up. If we want the trans compound, then we need to have the methyl on the opposite side of the ring. The methyl needs to point down at position three.

00:02:42:53 - 00:03:24:48
Instructor: We look at position three here and there should be an axial and an equatorial position there. Because these two bonds are pointing together downward, we know that the axial position will be pointing down. The equatorial position we'll look at in just a moment. But we decided we have up for the ethyl, since it's trans, the methyl must be down and there's our compound. Now, for practice, we could draw the position of that hydrogen that is in the equatorial position at position three.

00:03:27:42 - 00:04:00:02
Instructor: To draw that equatorial position. Again, we look for the set of bonds that are forming the vertex of the carbon. Go to the other set of parallel bonds that have not been used to form that carbons position. In that case, it's going to be, well, if we're using these two, then it'll this bond and that bond are the set of parallel lines that we're going to use as our guide. We're going to be parallel to them, but we don't want to go down because we already have the axial that's down.

00:04:00:02 - 00:04:21:98
Instructor: We need to have that the hydrogen would be up. We could have practice drawing where all the other positions are. We can see that this is down axial, this will be up axial, down axial, up axial, down axial, up axial . . .

00:04:22:95 - 00:05:03:73
Instructor: and around the ring. Then we can fill in the equatorial positions recognizing that in each case, they need to be parallel with a set of lines that form the ring. If those are two parallel lines, then we've got this set here that are unused to form the down equatorial, then we're going to have an up equatorial here, a down equatorial here. We've already got the ethyl group in the equatorial position at that carbon. Here, we have a down equatorial, and we have the last one that we've already filled in, and we've completed our chair conformation.

00:05:03:73 - 00:05:41:92
Instructor: Now, generally, those hydrogens, we leave them implicit. You don't need to show the hydrogens —only the other groups, the methyl and the ethyl. Now, we could have put that ethyl in the axial position. And since, we are going to want the trans isomer— that's what we've decided to draw— that would influence how we draw the methyl. One way you could have put it in a different position and that would change what your structure looks like, and yet it still could be a correct answer.

00:05:41:92 - 00:06:00:15
Instructor: There's multiple correct ways to draw this. But we can get to that other option by doing the chair flip. Let's try and do that now. We initially had our parallel lines going up here. We're going to go the opposite and form the other chair.

00:06:00:15 - 00:06:34:30
Instructor: Now we draw those bonds and connect it together, and I formed my opposite chair. Carbon one, which used to be pointing down is now inverted to point up. The ethyl group that used to be in an equatorial position will now be in the axial position. It was up equatorial. It remains up, but it switches from up equatorial to up axial, and there's our ethyl group.

00:06:34:30 - 00:07:23:41
Instructor: The methyl that used to be in an axial position— axial down—will now move to an equatorial down position. And here—this one, two, three— this is that carbon, and it's going to now be down equatorial right there. There we have are two chair conformations for trans one ethyl, three methyl cyclohexane. Now to help you try and decide where each position is going to be—up or down, axial or equatorial—you can build a little table to support you in making these decisions. Let's do that now. If we

00:07:23:41 - 00:08:13:81
Instructor: describe each of the positions around the ring, what will be axial, and what will be equatorial? We have positions one, two, three, four, five, and six around the ring. If position one was initially an equatorial up and an axial down, then it switches at the next carbon. Position two would be up for the axial down for the equatorial. We can see that at position two, the axial is up, the equatorial is down.

00:08:13:81 - 00:08:45:53
Instructor: At position three, it will switch again to be down axial up equatorial. Down for the axial, up for the equatorial, and that pattern continues all the way around the ring. You can use this to guide your decisions of where you anticipate a particular group to be, just recognizing that it might switch if you're looking at the other chair, what the first position will have as up and down.