Another Example Analysis Using Both IR and H-1 NMR

Transcript

Instructor: Brett McCollum

00:00:00:40 - 00:00:31:22
Instructor: The purpose of this video is to help you manipulate a physical representation of cyclohexane, that way you can identify the important features of the molecule. Here, I have a representation of cyclohexane. What I've done just to help us is I've made six of our hydrogen atoms white. You can see one here. I've made three of them green and three of them violet.

00:00:31:22 - 00:01:03:43
Instructor: That's just going to guide our eye as we manipulate our model. We have our six carbon ring with two hydrogens on each. You notice that it doesn't want to sit flat, it's not on a plane. We're going to manipulate this to find both the chair conformation and the boat conformation. First thing we want to do is choose four atoms to be the plane of our ring with the other two positioned above and below that.

00:01:03:43 - 00:01:22:90
Instructor: I'm going to choose these two here at the front and the two opposite of them at the back. That is my plane right there. You can see that they're sitting together in a plane. I just check the other two atoms. One of them is up here, it's above the plane.

00:01:22:90 - 00:02:09:96
Instructor: And the other carbon atoms down here, and I wanted it to be below the plane that the four created. When we think of the phrase of a chair conformation, these four atoms are the seat of our chair. Then we have one carbon atom that is the head rest and the other carbon atom over here, that's our foot rest. Someone can relax sitting in the chair, rest their head here, and their feet, come down and rest down here. Now, in this orientation, we see that we have three of our hydrogen atoms pointing up.

00:02:09:96 - 00:02:51:32
Instructor: Three pointing down and the other six or around the ring, but they're not directly in the plane. This one here is pointing slightly up, and this one is pointing slightly down. The ones that are directly up and down, we call those axial. The ones that are slightly

above and below the plane, we call equatorial. We can still distinguish axial up, separate from axial down, equatorial up, distinct from equatorial down.

00:02:51:84 - 00:03:44:37
Instructor: Now, let's manipulate our model to switch to the other chair conformation for the molecule and see what happens to the hydrogens. Keep in mind at our starting point, the green are up, the violet are down, and the white are in our axial, sorry in the equatorial positions. First thing we want to do, we want to take our chair, and we're going to just twist a little bit here. This has put us into the put us into a half chair process where we still have our head rest, but we've lost our foot rest now. Five carbon atoms are in the plane, one is not.

00:03:44:37 - 00:04:14:24
Instructor: From that, twist some more, and now we have this really odd shape Nothing's really in the plane anymore. This is our twist boat, then push. This one up that used to be our foot rest. Now both the head rest and the foot rest are coming toward you. The other four are back sitting in the plane like they had before.

00:04:14:24 - 00:04:53:17
Instructor: We really just brought that foot rest up. We have a boat. It's a little hard to see from the video, you're going to need to build your own molecule and try and manipulate to go from the chair to the boat conformation. Now, from boat, we're going to twist the other side and then bring that down into the plane. Now we have five carbon atoms, one, two, three, five in the plane with the last one above, and then push it down.

00:04:53:17 - 00:05:15:46
Instructor: And we have our other chair. The four atoms that were in the plane before are the same four in the plane now. But we've switched, our foot rest is now a head rest. Our head rest became a foot rest. Look at what happened to the hydrogens.

00:05:15:46 - 00:05:48:66
Instructor: Originally, the green atoms were pointing up and they were axial. They were going straight up. Now they're still pointing up a little bit, but they're equatorial. The violet atoms, they were originally pointing straight down, but they've twisted themselves to now be equatorial down. We've maintained things pointing up or down, but we've switched between a position of axial and equatorial.

00:05:48:66 - 00:06:35:18
Instructor: In the same way, our hydrogen atoms that used to be pointing just slightly up, have swung to be vertical axial up, and those that we're pointing slightly down are now pointing directly down. They went from equatorial down to axial down. If we want, we could just reverse that, twist, twist, boat, twist, twist, and we have back to the original chair with the chlorines or the green hydrogens pointing up, the violet hydrogens pointing down and all the white ones back in those equatorial positions. Go build your own model and give it a try.