SN 2 Mechanism

Transcript

Instructor: Jess

00:00:00:00 - 00:00:23:32
Instructor: I'm going to take you through an example of an SN two reaction. I'll start by drawing a molecule. Put a methyl here. I'm going to put a What did I say I was going to put? I'm going to put a fluorine there.

00:00:24:24 - 00:00:57:83
Instructor: I'm going to put an OH here. And I'm going to put an iodine here. So this is a pretty complex example. But if you were faced with something like this, you first want to decide what you're going to use as your nucleophile. So if you ever see Bruno and Costco, he will ask you what makes it a nucleophile and it'll be really stressful.

00:00:57:83 - 00:01:29:48
Instructor: But essentially, you want it to be basic. You want it to have a negative charge. You want it to be electro negative, so you want it to pull electron density towards itself. You want it to be a small molecule, so have little steric hindrance. And you want it to have lone pairs.

00:01:30:84 - 00:02:01:72
Instructor: So now I'm going to choose, let's dry an arrow. Just go and go that way. Draw an arrow, we're going to do KCL is my nucleophile. Then you need to pick a solvent. So for SN2 reactions, you want to pick a polar aprotic solvent because you don't want the protic solvent.

00:02:01:72 - 00:02:31:77
Instructor: So a protic solvent with hydrogen bond, which would make the reaction less effective. So you want to choose something that has differences in electrons. You want something that has differences in electrons, and you want it to not hydrogen bond. So the three I kind of flip flop between it's acetone, DMF, and DMS). Ops DMSO. It looks like a G.

00:02:31:77 - 00:02:50:63
Instructor: DMSO there we go. Honestly, I just pick out of those three based on vibes and I switch it up. If I use too many of the same one. I use no logic between these three, I just put whatever down. Um, so let's put DMF down 'cause it's the fewest amount of letters.

00:02:51:45 - 00:03:09:65
Instructor: From here, you're going to want to decide. Drop something :(. You're going to want to decide what is your leaving group? So what things make a good leaving group? You want it to be electronegative?

00:03:10:17 - 00:03:41:17
Instructor: So if we compare between fluorine and oxygen, Fluorine is more electronegative than oxygen because fluorine is further to the right on the periodic table. So you would choose fluorine for electronegative. And you would not choose oxygen. But between fluorine and iodine, you want to pick something that's bigger. So iodine, iodine is a big guy (like the editor).

00:03:41:17 - 00:03:57:65
Instructor: Iodine can carry lots of things. Iodine is strong, Iodine's big. And then you have this puny little toddler over here, fluorine's not gonna do you very much. So, this guy massive. So you're not gonna choose the toddler Flourine.

00:03:57:65 - 00:04:26:65
Instructor: You're gonna choose the big, strong Gymbro guy iodine, because he can hold the negative charge. So iodine here, it's still electronegative, so it's pulling electron density towards itself. So it's partially negative, making this carbon partially positive. This partially positive carbon, carbon still wants to be negative. And iodine Iodine doesn't care.

00:04:26:65 - 00:04:45:83
Instructor: Iodine wants all the negative. So chlorine over here, chlorine's electrons. There are two electrons. Chlorine is like, Hey, I can help you out because chlorine is negative and it's just bound with potassium for convenience. But chlorine's like, I can help you out.

00:04:45:83 - 00:05:07:35
Instructor: Chlorine is going to go all the way over here with its electrons and go to this carbon because it's this carbon that wants the electrons. Iodine doesn't want electrons from chlorine. Iodine wants electrons from the carbon. It's the carbon that wants the electrons back. So the chlorine's helping a brother out.

00:05:07:35 - 00:05:33:72
Instructor: It's going to make this funky little transition state. Like this where you have iodine, which is in the process of leaving and chlorine, which is in the process of coming in. We'll draw little arrows. This guy's leaving. It's an arrow right? Yeah, there we go.

00:05:33:72 - 00:05:57:38
Instructor: Um you also have your hydrogen hanging out still that still exists. So there's five bonds. Transition It's this transition state. So this chlorine bond and this iodine bond are not full bonds, they're only partial bonds, so it still falls within the rule of four bonds on a carbon. However, Iodines leaving.

00:05:57:38 - 00:06:10:80
Instructor: Iodine. This is a concertive mechanism. So this is not really existent for very long. It's just like sporadic. If you look at your little energy diagrams, it's at defame top.

00:06:10:80 - 00:06:26:08
Instructor: You're right here on your little energy diagrams. Now you want to come back down. Not sure if this would be exothermic or endothermic, so just ignore if this is exo ando. But you're at the top of your little energy diagram. So iodine is going to take the electrons.

00:06:26:08 - 00:06:42:42
Instructor: Remember, the arrows represent electrons. So the arrow is literally just your electrons, M two. Traveling. They need a little path to travel. Holy cow, this was a long line.

00:06:42:42 - 00:07:24:96
Instructor: They need a path. Now, this guy can take his electrons from the carbon. So he's taking the electrons. And now Iodine is able do a big, strong iodine with his buff muscles is carrying his electrons that he stole from he's a negative charge, and he's carrying his electrons that he stole from the carbon. And the carbon is now happy because the carbon was able to get the electrons from the chlorine, leaving a molecule that looks like this.

00:07:27:24 - 00:07:57:48
Instructor: And remember, chlorine came in from the technically the backside attack, but iodines in the back. So it came from the front. So now chlorine is at the front because Iodine was hanging out at the back door, so chlorine snuck in through the front door. This is a CL. And so now you got your happy molecule :), and Iodine's happy with his electrons over here, and you've just completed an SN2 reaction.