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# SN1 Mechanism

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## Transcript

Instructor: Alia

00:00:00:00 - 00:00:20:16
**Instructor:** Hi, guys. I'm going to be talking about SN one reactions. So SN one reactions. So SN one reactions are different from SN two reactions in that they have three steps that you typically would follow. The first is the formation of a carbocation.

00:00:22:00 - 00:00:53:42
**Instructor:** The second is a nuclephilic attack. And the third is a deprotonation step. We're just going to get right into examples. For our first example we can make use of It's a bromine. The first step is the formation of a carbocation.

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**Instructor:** And for that first step, the electrons. This carbon is Delta positive, partially delta positive, and this bromine is Delta negative. This bromine is very electronegative, so it wants to pull electrons towards itself. So the electrons will move from the carbon towards the bromine, and then this one becomes positive and you form the carbocation. And then you have the bromine that's negatively charged.

00:01:28:91 - 00:01:58:07
**Instructor:** Now, one thing to note is that SN one reactions are unimolecular, and so their rate depends upon the concentration of the reactants. So really, this first step is like the rate determining step. So whatever happens in this first reaction kind of determines how fast the reaction is going to go. So this is like a first step. Okay, so for the second step, we form the carbocation.

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**Instructor:** Now we make use of a nuclephil. For this reaction, we're just going to use water, and the water has lone pairs. And so this has lone pairs, and the carbon is positive, so it wants electrons. So the electrons from the oxygen will go and attack this carbon, and then you form this molecule. That's for the second step. Now for the final step,

00:02:24:59 - 00:03:11:49
**Instructor:** the final step is a deprotonating step, and it's basically just losing one of the electrons from this oxygen. However, depending on the nucleophile you use, you could actually just have only two steps. So for example, if you have H2O versus cyanide, this cyanide doesn't have a hydrogen, so once the nucleophile should attack the carbon, then it wouldn't need a deprotonating step because there's no hydrogen. But since we're using water, we're going to have a deprotonating step. And for the deprotonating step, you can make use of the bromine that you kicked off earlier on, or you could use water again just depends on what you want to do.

00:03:11:49 - 00:03:29:87
**Instructor:** So you can then take this hydrogen. Like I said, this is negatively charged. This is partially delta positive because the oxygen is negatively charged. So it takes this hydrogen and then the electrons move to the oxygen. And then you have your final reaction or your final product, rather.

00:03:29:87 - 00:04:12:72
**Instructor:** Okay, so for the earlier example, we made use of this molecule. And when the nucleophile attacked it, it could only really attack from, like, one position. So when we had the H20 could only attack from here and then form the product. But it's different when you have sterics, stoichiometry involved. So we're going to use an example involving stereochemistry, see if we have something like this.

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**Instructor:** Then the first step is the formation of the carbocation, the electrons will move to the bromine, and then you form this and then, so this is the first step, the formation of the carbocation. And then for the second step, that's a nuclephilic attack. So So depending on where the nuclephle is attacking, the product you would get would be slightly different. So we're just going to use water as a nucleophile. So if the water should attack from the back here, then we'd form this product.

00:05:17:93 - 00:06:10:67
**Instructor:** If the water should attack from the front, then we would form this product. So because this CH three is at the front, it's kind of blocking the path that the water would come to attack at the front. So the product that's formed from the OH attacking from the front would be like a minor product because of the steric hindrance of the CH three. And then this molecule that is coming and attacking from the back since there's nothing blocking it, it'll be like the major product. And these two molecules are diasteriomors.

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**Instructor:** Remember when stereochemistry is involved, the product that's formed is different and the major and the minor product are formed the major is in a 90% to 10%. Meanwhile, for this example, since it only attacked from one position, then it would be 100% of this product that's formed. Yeah. So next we're going to talk about some of the things that would affect the rate of an SN one reaction. The first thing is the solvent.

00:06:48:97 - 00:07:19:85
**Instructor:** There are different types of solvents. SN one reactions primarily require or prefer a polar prudic solvent. For example, water methanol, Water ethanol, et cetera. So ethanol. These are examples of polprodiclvents.

00:07:19:85 - 00:08:12:74
**Instructor:** We're going to use the first example we used. For making use of water as an example of a polar protic solvent, I have H, and this is positively charged, and this one has lone pairs. So there's, then a bond is formed between them. And this stabilization of the water between for the carbon that's positively charged is why SN one reactions prefer polar protic solvents. So for example, if you're using between it's between water versus acetone, for example, the rate, the rate for water would be like 400,000, and the rate for acetone would be like one.

00:08:12:74 - 00:08:41:06
**Instructor:** So the rate of the SN one reaction with using water as a solvent is a lot faster than if you're using acetone. That's one of the things that affects the rate of an SN one reaction. So another thing that affects the rate of the SN one reaction is the leaving group. So there are different types. There are different types of molecules that act as better leaving groups versus others.

00:08:41:06 - 00:09:24:52
**Instructor:** So say, for example, if we're looking at between water and iodine and fluorine and chlorine, so the weaker the base, the better it is as a leaving group. So, if we're looking at the electronegativity, we know that the electronegativity increases from left to right and from bottom to top. So between oxygen, iodine, fluorine and chlorine, the most electronegative would be fluorine. So it's the most negative, kind of. So it wouldn't like it'll be a lot harder to, like, break that bond between the carbon and the fluorine.

00:09:24:52 - 00:10:09:51
**Instructor:** So it'll be the least the worst leaving group, kind of. And then from there, the next most electronegative, I would say would be like chlorine and then iodine. And then the best leaving group would be water because it's not really a great, like, base, stuff like that, and it's not as electronegative. So between these three, this would be the worst and this would be the best. Earlier on the video, we briefly talked about nucleophiles and which ones are better nucleophiles depending on electronegativity and size and all of that.

00:10:09:51 - 00:10:46:95
**Instructor:** But another thing is that the nuclephils don't really affect the rate of the reaction because the rate is really depending on this first step. It's like the rate determining step. So the nuclephilic attack that comes in the second step, it won't really affect the rate of the reaction, but the type of nucleophile you use will change the product that you get. So if you already formed the carbocation from bromine leaving that we used in the first example. So the type of nuclephile will affect the product that's formed.

00:10:46:95 - 00:11:34:19
**Instructor:** So if we're using between, um, And, uh, water. So we also mentioned before that, it's better to have a negatively charged nuclepile than one with lone pairs. So with this nuclephile you would form this product. And with this nuclephile you would form this product. And for this one, assuming we've already done like deprognation and everything.

00:11:34:19 - 00:12:08:71
**Instructor:** So because this one's this one's a better leaving group, but it's a poor nuclephile and this one is like a poor leaving group and it's a better nuclephile. So this one would be like a major product. And this one would be like the minor product. So if you're asked if you're giving something like an example like this and they ask you which one would be the major which one would be the minor product, remember, the one with the better nuclephile would act as a major product and the one with the worst nucleophile would act as a minor product.