



## E1 Mechanism

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### Transcript

Instructor: Garrett

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**Instructor:** Hi, my name is Garrett, and today we're going to be working through some E one problem types and predicting the major products. So we're going to start with this problem here. The first thing you want to look for is the leaving group, determine if it's good or bad. Here, we have a halogen, which is a good leaving group. Second, you want to look at the nucleophile, determine if it's strong or weak.

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**Instructor:** Here, methanol is a weak nucleophile, which favors E one reactions. Third, we have the addition of heat, which is denoted by the Delta symbol. Fourth, I always look at the type of substrate we have. Here, the leaving group is on a secondary carbon, and for E one, you want to have a secondary or tertiary carbon. So the electron from the bond are leaving to the bromine. Now we going to form a carbo cation and there is our carbo cation, from the carbo cation formation you can go two ways, you can go SN 1 or E1. We have discussed before since the addition of heat this product is going to favor E1 but when I am doing examples I like show the E1 path as well as the SN1 path to get practice doing both ways. So now I will show you the SN one pathway and the first step of the SN one reaction is the attack of the nucleophile.

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**Instructor:** So the lone pair on the nucleophile is going to attack the positive carbocation on the substrate. And since the carbocation is flat, it can attack from the front side or the back side, so we have to draw both products of stereochemistry. Our nucleophile has attacked from the front side and the back side, and it still has a positive charge. So there is still leftover base in the solution, which will extract the proton and the electrons will be donated to the oxygen. And the same thing will happen here.

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**Instructor:** Y. So at the end of our SN one reaction, we have a racemic mix of the backside attack, which would be here and the front side attack, which would be here. Now we will

move on to the major product, which is the E one reaction. Treat again. Now on to the E one reaction.

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**Instructor:** And again, we know this will be the major product because heat was indicated in the reaction conditions. So when you're looking at E one, the first thing you want to do is identify your beta hydrogens. So the Beta hydrogens are going to be located one carbon away from your carbocation. So we have a beta hydrogen here, and I will call that HA, and we have another beta hydrogen one away over here. Now that we've identified both of our Beta hydrogens, the next step is the nucleophile will act as a base and strip the hydrogens.

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**Instructor:** So the lone pair will attack each of the hydrogens and the electrons will be donated to the carbon bond. And since there are two pathways, I will show A here. So HA, the electrons are donated to this bond and HB. The electrons are donated to this bond. So now we have two products for E one.

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**Instructor:** We have to determine which one is more stable, which will in turn determine which one is more favorable. So the major product will always be the most substituted product in E one reactions. So as you can see, the HA product has two carbon substituents off of the double bond. HB only has one carbon substituent off of the double bond. This will make HA the major product.

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**Instructor:** Good. So here's a quick review of our first E one reaction. We've identified our leaving group, our nucleophile, and our secondary carbon which contains the leaving group. First step, the leaving group left, or carbocation was formed. From here, you can either go SN one or E one.

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**Instructor:** We know the major product will be E one because heat was indicated in the reaction conditions. We showed SN one conditions as practice. So the nucleophile will attack the carbocation either from the front or the back. This introduces stereochemistry. With the SN one reaction, we showed it as practice.

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**Instructor:** So the first step, the nucleophile will attack the carbocation. Since it is flat, it introduces stereochemistry, which we showed a backside attack and a front side attack. The nucleophile is still positively charged, so the nucleophile will act as a base, take a proton from each, and we are left with our final SN one product, which will be a racemic mixture of both. And finally, we worked on our major product, which is the E one reaction. We identified two Beta hydrogens, which were labeled HA and HB.

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**Instructor:** These hydrogens were located one carbon away from the carbocation. The nucleophile acts as a base and can strip either of these protons in two separate reactions. Our two products are over here. HA forms a double bond in the middle and HB will form a double bond at the end. Now we've determined both of our products.

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**Instructor:** We need to determine which will be the major product, which will be the most stable, which will be the most substituted alkene. Again, HA was the most substituted, so we determined it to be the major product and that will be the answer for this question. Now we're going to go over a second E one example and we're going to only show the E one products, but you can try the SN one products as practice. We're going to look, we have a weak nucleophile. We have a good leaving group.

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**Instructor:** This leaving group is called triflate. It is stabilized by resonance and has strong electron withdrawing groups, which makes it a very good leaving group, and our leaving group is located on a tertiary carbon which further supports E one reactions. And finally, we have heat, which pushes us more towards an E one reaction as well. So first step once we've identified the leaving group is the leaving group leaves. So our triflate will leave.

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**Instructor:** So now I've drawn out the carbocation and I've also identified three of the beta hydrogens. So HA is in orange, HB is down here in green, and HC is in pink. Now that we've identified our beta hydrogens, we will first start by eliminating HA. So our nucleophile is water. The electrons will come and extract this hydrogen, and these electrons will be donated to this carbon bond.

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**Instructor:** We will end up with this product. Now we've eliminated HA. So let's go and work on HB. The same thing is going to happen. Our nucleophile will take this hydrogen, and the electrons will be donated to this carbon bond.

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**Instructor:** So let's see what that looks like. And finally, we have HC. Again, the nucleophile will take this hydrogen. It will the electrons will be donated to this carbon bond. Now that we've determined all of our E one products, we have to determine which is the major product by determining which alkene is the most substituted.

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**Instructor:** So if we will first look at the HA product, it has four non hydrogen substituents. The HB product has three non hydrogen substituents, and the HC product only has two non hydrogen substituents. So looking at these, HA will be the major product because it is most substituted. So we've identified our major product. Now we can identify our minor product, which will be the least substituted, which is HC, the product of HC.

00:12:09:64 - 00:12:36:66

**Instructor:** And HB will be somewhere in the middle of the major and the minor product. In this example, we determined three alkene products for this E1 reaction. First, we formed the carbocation. Seen here. And then we identified our three Beta hydrogens, which were all located one carbon away from the carbocation.

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**Instructor:** From there, we labeled them HA, HB and HC. The HA product formed the major product, since it was the most substituted. The HB product was somewhere in the middle since it had three substituents, which were not hydrogen, and the HC product formed here was minor because it had the least number of substituents on the alkene. That was great.