Alkyne Chemistry

Transcript

Instructor: Cali

00:00:00:00 - 00:00:13:48
Instructor: Today we're going to be talking about reactions with alkynes. Alkynes are very similar to alkenes except they contain a carbon triple bond.

00:00:15:04 - 00:00:30:96
Instructor: In this triple bond, there's one Sigma bond and two Pi bonds. We have to note that when we are drawing alkynes, we have to draw them in straight bonds.

00:00:30:96 - 00:00:39:60
Instructor: So there's two ways that we can draw them. So that's the first way, or you can also draw it like this.

00:00:41:37 - 00:00:55:17
Instructor: So normally a bend in line denotes a carbon, but since this is linear, there's actually a carbon right here, here and here. And the gaps here also represent a carbon.

00:00:55:17 - 00:01:05:33
Instructor: Similarly to reactions with alkynes, they can either proceed Anti-Markovnikov's or Markovnikov's. Today we're going to be focusing on Markovnikov's reactions.

00:01:05:33 - 00:01:12:81
Instructor: Recall that in Markovnikov's reactions, the rich get richer. Let's take a look at an example with Pentene H-Cl.

00:01:12:81 - 00:01:23:39
Instructor: This is an example of a hydrohalogenation. The first step in this mechanism is the formation of a carbocation.

00:01:23:39 - 00:01:44:40
Instructor: The triple bond attacks the hydrogen, then the hydrogen passes the electron density to the chlorine. As we can see here, the rich got richer and the hydrogen got added to the primary carbon.

00:01:46:44 - 00:02:03:72
Instructor: The next step in the mechanism is the Cl ion attacks the carbocation forming an anti product. Since it is difficult to stop at one addition, this reaction proceeds again.

00:02:03:72 - 00:02:13:40
Instructor: The Cl adds anti across the double bond to avoid steric. Often H-Cl is present in excess, so this reaction happens again.

00:02:19:28 - 00:02:35:74
Instructor: As seen, this reaction is similar to that of alkenes, except with the double addition, it produces a geminal dihaloalkane. geminal dihaloalkane is when two of the same halogens are bonded to the same carbon molecule.

00:02:35:74 - 00:02:46:24
Instructor: Here you can see that we have two Cls coming off of the same carbon. Now when you're presented with this problem on a test, you'll know the mechanism to solve it.

00:02:46:24 - 00:03:03:82
Instructor: First, an electron dense alkyne attacks the hydrogen, creating a chlorine ion and the formation of a carbocation. The H is added to the carbon that has the least substance on it, also known as Markovnikov's, where the rich get richer.

00:03:03:82 - 00:03:21:04
Instructor: The chlorine then attacks the carbocation, adding an anti across the double bond to avoid sterix. Since HCl is normally present in excess, this reaction occurs again, producing the final product, which is a geminal dihaloalkane.

00:03:21:80 - 00:03:30:22
Instructor: The next reaction we will be looking at is hydration. This reaction involves the addition of OH and H across the double bond.

00:03:30:22 - 00:03:46:50
Instructor: After the reaction mechanism has proceeds, an enol product is formed where there's an OH directly attached to the carbon double bond. It it. As we can see here,

00:03:46:50 - 00:03:55:98
Instructor: the OH is directly attached to a carbon that is involved in the double bond. The enol then tautomerizes to a more stable keto form.

00:03:55:98 - 00:04:11:70
Instructor: The C double bond O is normally surrounded by two carbons. The keto form is more stable because the C double bond O has higher bond energy.

00:04:11:70 - 00:04:26:32
Instructor: Let's take a look at the same alpine from the previous example. In order to add the H and the OH across the triple bond, we need H + H2O and HgSO4.

00:04:26:32 - 00:04:50:29
Instructor: The mercury of salt is needed to catalyze the reaction. Now, if we see a question like this on the test and it has these reagents, the H+ H20, and HgSO4, you know that an OH and an H are going to be added across the triple bond in Markovnikov's.

00:04:50:29 - 00:05:16:23
Instructor: Since the reaction is Markovnikov's, we can predict where the OH and the H are going to add across the triple bond. We can see here, we have predicted that the OH is going to attach to the more substituted carbon, and the H is going to attach to the primary carbon on the end of the alkyne chain.

00:05:16:23 - 00:05:33:85
Instructor: Since this is a predict product problem, we can now draw the final product where our OH and H are going to be. The enol form of the product is not very stable, so it acts as an intermediate in this mechanism.

00:05:33:85 - 00:05:46:17
Instructor: It now goes to its more stable keto form as talked about earlier. We now know that when we see an enol with these reagents, it's going to go into a keto form as the final product.

00:05:49:00 - 00:05:55:90
Instructor: We now have our final product, which is the keto form. The keto has the C double bond O.

00:05:55:90 - 00:06:08:78
Instructor: Now when you see this problem on a test, you know what the final product is going to look like. We start with an Alkyne and these reagents, H+ H2O and Hg SO4.

00:06:08:78 - 00:06:27:70
Instructor: Since this is Markovnikov's reaction, we know that the OH is going to go where there's more substance and the H is going to go on the end where the rich get richer. The intermediate in this reaction is an enol that has an OH directly attached to the carbon double bond.

00:06:27:70 - 00:06:39:26
Instructor: It then tautomerizes into a keto that has the C double bond O. The keto is more stable due to the higher bond energy between this carbon and the oxygen.