Notes:

Structure, shape and reactivity of a reactive intermediate: carbanion with respect to structure and shape.

Model number 10, Course title in organic chemistry. An organic chemistry section B

What are carbanions and why are they needed?

Carbanions are carbon species with negative charge.So whenever we talk about anions, its the species with negative charge.So carbanions, as the term goes. These are carbon species with negative charge.

Why they are needed?

Organic synthesis. carbanions are absolutely important. They form basis for name reactions like aldol Knoevenagel reactions and so on.

Definition and importance of the carbonanions is important concept. We will also look into the formation and structures of different carbonanions ie Primary, secondary and tertiary carbonanions.

Shapes of different carbonanions with some simple examples one should be able to exlplain at the end of this module.

They also **form important part of synthesis of bio active molecules, drugs etc. That tells how important carbanions are.They also gives insight into pH of molecules.**

Reactive intermediates. Once carbon has negative charge the Carbon tries to give away this negative charge. As you can see in the lightning, the sound and light is the byproduct, But there also the same phenomena occurs. It tries to give away the charge. Likewise, carbon also tries to give away the charge. Hence these are called reactive intermediates.

You can see I have listed few reactive intermediates, carbanions, carbo cations, radicals and others like benzyne. Charge on carbanion is negative and have already seen Carbocation positive whereas, radicals have single electron.

But we are not going to touch other aspects in this present module. We will only focus on carbonions.

Let us go into the detail of structure of carbon ions. We need to know how the breaking of bond Works.

So we have seen **formation of carbanion involves heterolytic cleavage**. Heterolytic cleavage wherein the whole electron density is taken by one of the atom along a bond and in this particular example its a carbon. Hence, that particular carbon is negative in charge (carbanion).

In turn, it gives away hydrogen with no electron. That's why this is in positive charge. We call that as proton. And whenever species gives proton, we say that species is acidic in nature. likewise, I have already mentioned carbanion study gives beautiful insights into pH of. Carbon with negative charge. That is, carbanions. We also call it as conjugate base whenever it comes into acidity aspects.

Just we will brief about this particular case. Suppose imagine hydrogen goes with whole electron density. We know electrons are negatively charged. Hydrogen will have negative charge.Carbon will be left with
positive charge. That is called carbocation.
We will focus on Carbanions. Very interesting aspect of this is the Structure as you can see in module how beautifully the tetrahedral nature of the parent molecule Has turned into a pyramidal shape once this Hydrogen is lost in a form of proton. So you can see formation of tetrahedral to pyramidal shape it has acquired.

structural aspect of carbonions into much more details.

We have primary, secondary and tertiary carbanions.Let us look into that.

We have already seen.The formation of Carbonions and changing the geometry from tetrahedral to pyramidal in case of Sp3 hybridized carbon centre of carbanion.
Similarly. Replace Both hydrogens with R and you end up in secondary carbanion. and hence in 3rd case all three hydrogens with be R group. Now R is any group other than hydrogen. Now the resulting carbanions is tertiary carbanion. To simplify the following may be followed again
One hydrogen was replaced we ended up in carbanions which is primary.
Two hydrogens are replaced. We ended up in. Secondary carbanions.
And if we replace all three, the resulting carbanions is going to be. Tertiary carbanion.

So we have seen how the structure that is primary, secondary and tertiary carbanions
With these few simple examples.
I've taken simple example of two methylpropane, next is this benzene. Well known figure in organic chemistry and propyne.

So let us consider. And Apply the same logic. Electron density goes to a carbon to give. carbanions

so it has ended up in this carbon species with negative charge. Hence this is carbanion.

This one is also carbanions and this one also is carbanions and but what is the difference?

This is Sp3 hybridized carbon.This is Sp2 hybridized carbon and this is a Sp hybridized carbon.

In SP hybridized carbon there is more of S character. To be precise it is 50% in two it is1/3 S. It is 1/4 in the Sp3 case.

So **shape with respect to hybridization is important** and in modulewe have simplified same with example.

These forms.Pyramidal from tetrahedra. We know coplanar structures like benzene. They will be slightly distorted. In particular they will be called as bent. And SP hybridized carbon.That is linear.With the negative charge they will be linear in shape, so we have learned.Pyramidal.Bent. And linear shapes for the carbanions.

Now shape and structure of carbanions also constitute to the stability. Let us see which one is the most stable and the least stable ones from what i have given here.Nice order in which stability goes ahead. I
have already told more this *S* character More is the stabilized carbanions youcan see here.

So Sp hybridized carbonions Will be the most stable one.Then comes as Sp2. Then comes Sp3
Into that the primary are the most stable and tertiary are the least so it all depends on electron donating groups which destabilizes the carbon. It is like. More the donating groups.More electron density will be pushed onto the carbon which is already negative in nature, so it will

destabilize. Just imagine having electron withdrawing group. It will pull that negative charge away from the carbon center hence making that species slightly or relatively stable.
Let us summarize what we have learned in this module.

Carbanions are the species of carbon species in particular with the negative charge.It forms a basis for the concepts of name reactions, pH and so on. We have also studied Sp, Sp2 and Sp3 hybridized carbon ions and its formation.

We have also noted primary,secondary and tertiary structures of carbonions. We have also seen their formations. We have learned different shapes of carbonions. Pyramidal.Bent and linear

We have cited very interesting & easy examples in order to understand structure and shape of carbonions. These are some of the reference which I followed.

And you can always follow these for further reading.

Thank you.