welcome you all to chemistry in this problem solving session we will try to cover concept based problems of hydrocarbons as all of you know hydrocarbons can be divided into two groups aliphatic and aromatic hydrocarbons aliphatic hydrocarbons can be further divided into saturated and unsaturated hydrocarbons saturated hydrocarbons refer alkanes unsaturated hydrocarbons can be further divided into alkenes and alkynes now let us look at the problems the first one involves hydrogenation of compound a having molecular formula c7h14 produces a chiral compound b with molecular formula c7h16 reaction of compound a with ozone followed by dimethyl sulphide or zinc in water produces compounds c and d compound c shows a positive halo form and tolerant test identify a comma b comma c and d from the molecular formula of a we can predict it is an alkene as it fits with common formula cn h2n compound c shows a positive halo form and tolerant test it means it has a methyl group which is bonded with a carbonyl group when you have the methyl group which is bonded your carbonyl group it can show a positive halo form test and it also shows a positive tolerant test that means it is an aldehyde the structure of compound c is acetaldehyde once if you know the structure of c we can try to predict the structure of a this alkene

So when you do the hydrogenation it can convert into this alkane if you look at here this carbon is bonded with four different groups it is a chiral compound the structure of compound b is this one from this now we can predict the structure of compound d

So tolerance test all of you should know it is a silver complex when we use two equivalent of this silver complex with aldehyde it can oxidize to carboxylic acid where silver one will be reduced to silver zero this is often used to find out the presence of olive group in the molecule and when you have the methyl group which is bonded to the carbonyl group and it can be oxidized to carboxylic acid and halo form when you react with sodium hypo halide

So these are the test commonly used to find out the presence of methyl group as well as the earlier functional group

So in this reaction the alkene when we do the hydrogenation it gives a compound b as you can see here it is a chiral compound the carbon is bonded with four different groups oceanolysis already we have discussed and in this alkene undergoes one comma three cycle addition reaction to give the cyclic intermediate which rearranges to austenite

So this oceanide when you react with dimethyl sulphide for example you will be able to form the carbonyl compound plus this can convert into carbonyl compound and dimethyl sulfoxide now let us move to the next problem which involves the reaction of compound a having molecular formula c8h6 with hydroboration and oxidation yields compound f having molecular formula c8 hc8o that shows a positive fillings test while the reaction of compound e with water in the presence of acid gives g which shows a positive hello form test identify e comma f and g the compound f having molecular formula c8 h8o shows positive fillings test that means it is an aldehyde compound g which shows a halo form test that means it has a methyl group which is bonded with a carbonyl group from this we can try to predict the structure of e hydroboration oxidation it can be carried out if you have the phenylalase still when you do the hydroboration using boring like textile borane which can undergo addition reaction let me write r this portion as once if we have this one you can oxidize using hydrogen peroxide in the presence of sodium hydroxide to give enol which will convert into aldehyde the structure of compound f is one which is called as phenylalastaldehyde if you have the phenylstealin which can undergo hydroboration to give this intermediate this can be oxidized to enol that the enol can be converted into aldehyde filling solution is a mixture of copper sulphate and sodium potassium salts of starteric acid say copper to complex when you mix with aldehyde it can oxidize to carboxylic acid where copper 1 2 will be reduced into copper one oxide which will precipitate as red brown precipitate this test is often used to find out the presence of earlier functional guru in the molecule while the reaction of e with water in the price of acid is compound g this can convert into osteophenone you can see here compound g shows a positive halo form test that means it has a methyl group which is bonded to the carbonyl group when you treat this compound with the sodium hypo halide you can oxidize into benzylic acid and hello form the structure of compound e is now phenylal stelling if it is phenyl acetylene it can be reacted with borane to give this intermediate that can be oxidized to this enol this will convert into aldehyde which can show the positive fillings test on the other hand phenelastine can undergo addition with water hydration the pressure of acid to give this enol this will convert into ketone this ketone can be converted into carboxylic acid and halo form by reacting with sodium

hypoalloid and the structure of compound g is shown here this is astrophenol now let us move to the next problem complete the following reaction sequences the first example involves alkylation of aromatic system this can be carried out if you have propane in the presence of acid it can undergo protonation to give isopropyl cation which can undergo reaction with this benzene by aromatic electrical substitution to give the isopropyl benzene alternatively if you have the isopropyl chloride you can react with aluminum chloride to produce isopropyl cation which can react with benzene ring via aromatic electrically substitution to give this cumin once if you have this one this can be converted into phenol by its two step process first we have to react with oxygen to form a hydro peroxide once you form the hydro peroxide when you treat with acid it can give phenol when you react human with oxygen the benzylic ch bond undergoes oxidation to give cumulative peroxide once you form the female hydro peroxide when you treat with acid it can protonate this o h group to you this intermediate now the phenyl ring can undergo rearrangement
So to give this intermediate which can react with water can convert into phenol and a stone it is an industrial process this we use to prepare phenol
So depends upon the alkyl group in this case if you use this propene the pressure of acid you can protonate to form the isopropyl cation which can act as electrophile now can undergo aromatic electrical substitution to give this cumin once you form this one the bensley ch bond can undergo oxidation with the oxygen to form the hydro peroxide hydro peroxide the pressure of acid can undergo protonation to give this intermediate when can the phenology can undergo rearrangement to give this intermediate this can undergo reaction with water to form this and which can convert into phenol and are stone as the product alternatively if you have the isopropyl chloride we can also try to react with lewis acid like aluminium chloride and you will be able to form the isopropyl cation and aluminium tetrachloride which can act as electrophile which can undergo reaction with benzene ring to give the cumin which can be further reacted as we have seen earlier to give phenol and a stone as the product this is known as friedel crops alkylation the next example involves oscillation of aromatic ring here the benzene is converted into osteophenone this can be accomplished if you have the acetyl chloride which can be reacted with the anhydrous aluminum chloride to give this carbocation and aluminum tetrachloride this can act as a electrophile now which can undergo oscillation with this aromatic ring as just we have seen and you will be able to get this astrophenol as the product on the other hand you can also use acetic anhydride this also can undergo a reaction with aluminum chloride to give a saline carbocation which can undergo reaction with aromatic ring to give austrophenols the product this can be oxidized to benzoic acid just we have seen earlier when you react with sodium hypo halide you can oxidize into benzoic acid and halo form these are the important reaction the first example involves friedel crops alkylation if you have alkyl halide the effects of lewis acid can be reacted with aromatic system to give the alkyl benzene which can be further converted into useful compounds an extra example involves oscillation this is known as frittel crops oscillation if you have the acid chloride you can try to react with aluminum chloride to form the acetylene carbocation which can act as electrophile which can undergo aromatic substitution reaction with in this case this osteophenone can be further oxidized to benzoic acid using sodium hypo halide here the reaction of nitrobenzene with a mixture of nitric acid in the piece of sulfuric acid is shown you see a nitration reaction when you take a mixture of nitric acid and sulphuric acid you will be able to form anode plus which is electrophile which can undergo reaction with this aromatic system and here you look at already you have the substituent now in this case the nitration will take place in this position you will get this one comma three dinitrobenzene as the product this compound when you react with sodium sulphide it can selectively reduce one of the nitro group without affecting the other one to give this compound sodium sulphide is known to selectively reduce n o two we have the di nitro benzene it can one of the nitrograph will be reduced into amino group the other one will be intact now the position of this nitration is crucial here the nitration takes place at the meta position this is because if you try to write the resonance structure you will be able to understand if the reaction takes place in the meta position and you will be able to form the following resonance structures you have the electron withdrawing group and if you the nitration takes place this position you will be able to have this following resonance structure once you have this one now this can react this to give you the nitration product on the other hand if the nitration takes place for example in the para

position you will be able to have this resonance structure if you look at here it has the positive charge it is less stable when the nitration takes place para position you have this problem on the other hand the reaction takes place meta position you do not have this kind of intermediate therefore whenever you have the electron donating group the substitution reaction will take place ortho or paraposition on the other hand if you have the electron withdrawing group the reaction will take place at the meta position now let us look at the next example reaction of this alkene this hcl it can undergo this an electrophilic addition reaction and you will be able to have a carbocation intermediate secondary carbocation which can react with cl minus to give the addition product on the other hand this is a secondary carbocation which can rearrange now this methyl group can migrate to give a tertiary carbocation
So this carbide cation is more stable compared to the secondary carbon cation therefore the methyl group migration can take place and once you form this one now the cl minus can undergo a reaction then you will be able to form this chloro derivative
So in this reaction you will have a mixture of compounds if you look at the major product this will be the major product and first the alkene undergoes addition reaction with this proton to form a carbocation secondary carbo cation the secondary carbocation now leads to the rearrangement this methyl group really moves from this carbon to here and you will be able to form a tertiary carbocation this then reacts with this cl minus to give this chloro derivative now let us look at this example
So the reaction of this one three diene this hbr gives the addition product and in this reaction as just we have seen can react with this proton to give a carbocation which can
So under reaction with v r minus if you look at here this sterically hindered this tertiary copper cation this is then you can form this allyl carbocation this is can exist in the equilibrium which can undergo reaction to give this allyl bromide as the product in this reaction first it undergoes reaction of the proton to form the tertiary carbocation this is the allyl carbocation which can exist equilibrium this allele carbocation once you form this one this is sterically less hindered comparing to that therefore the b r minus undergoes reaction here to give this allyl bromide as the product this alkyne when you react with hydrogen the presence of palladium carbon catalyst the presence of quinoline this is crucial here it can undergo partial hydrogenation to give cis2 butane as a product on the other hand when you react with sodium and liquid ammonia and you will be able to form this trance to butane as the product
So when you look at the mechanism of this transformation when you have the palladium on charcoal which is absorbed the hydrogen now let us look at the next example this alkyne make relation with the palladium then the hydrogen adds the bottom face to give this intermediate once you form this one now it can undergo reaction here and it will be able to form the hydrogenation takes place the same phase of the alkyne you get the cis alkene as the product it does not grow further reaction because due to the presence of quinoline which can make chelation with your palladium it can reduce the reactivity of palladium charcoal therefore the reaction stops the alkene stage it does not undergo further reaction to give alkene as the product we don't have the quinoline it can further reduce the alkene into alkene as the product
So using this method you will be able to form the cis alkene as the product in this case you form two butane as the product on the other hand when you use sodium liquid ammonia you will be able to form the trans alkene trans to butane as their product formation of this can be explained as follows when you have the alkyne when you react with sodium it can give one electron to alkyne and you will be able to form a radical anion once you form the radical anion which can take proton from ammonia solvent the basic of this anion is higher comparing to this ammonia therefore it can take proton from the solvent to form this vinyl radical this radical can react with another sodium to form anion once you form this one as just we have seen it can take proton from the solvent to give trans alkene as the product this reaction you generate two equivalent of sodomide as a byproduct
So when you use sodium in liquid ammonia you will be able to convert alkyne into trans alkene on the other hand when you use hydrogenation in the presence of quinoline which is known as lindler catalyst you can carry out partial hydrogenation to give alkenes the product in this way you will be able to form cis alkene as the product now let us move to the hydration of alkene when you react methyl cyclohexene with water in the presence of acid you will be able to form the tertiary alcohol it can undergo reaction with this proton source you will be able to form the tertiary carbocation which can react with water

So to produce the tertiary alcohol as the product on the other hand if you do hydroboration oxidation you will get the other rejoicing the formation of this alcohol can be explained as reaction of alkene with the boring give the addition product the reaction is stereo specific the boring approaches from the less hindrance side the less substituted carbon syn addition takes place to give once we have this one this can undergo reaction of the hydrogen peroxide in the presence of base to give if you look at here this hydrogen and hydrogen group comes to the same side and the boron always approaches the less substituted carbon and you can get the opposite regio chemistry when you see the acid-base hydration and in the case of hydroporation oxidation you get this alcohol as the product now let us look at the next example worse analysis of this alkene in the pressure hydrogen peroxide as we have seen alkene can be converted into carbonyl compound by osnolysis in this reaction this alkene will be oxidized into a mixture of capacity acid you will get mixture of this coppasic acid on the other hand when you use hydrogen bromide in the presence of peroxide you can undergo addition reaction by a radical pathway the pressure peroxide for example when you use this peroxide you can under homolytic cleavage this can react with now this can react to the hbr to form we are radical this radical can undergo addition reaction with this alkene to form a secondary radical this radical now further can react with hbr and in this way you will be able to form as the product this regiochemistry is opposite to the electrophilic addition reaction in that the bromine will add in this carbon when you carry out the reaction by a radical pathway you will be able to form the this primary alkyl bromide as the product was analysis already we have studied and it can undergo addition reaction to form austenite as intermediate once you form this one when you do treat with hydrogen peroxide in this case it can undergo oxidative cleavage to give a mixture of these two carboxylic acids in place of peroxide you can also use oxygen it can also generate radical once you form the radical it can undergo addition reaction shown here and you will be able to get this alkyl bromide as the product the next problem is among the following compounds the aromatic compounds is or or if you look at the features that need to a compound to be aromatic the compound should be cyclic you should have a delocalized by electrons you should have four n plus two by electrons and it should be a planar for a compound to be aromatic it has to satisfy these three four points if you look at all these compounds are planar cyclic now we have to look at whether they have the delocalized pi electrons as well as whether they have four n plus two by electrons n can be 0 1 2 3 and
So on now let us look at here this is a cyclopropanol cation it has two pi electrons it has a delocalized pi electrons
So this is aromatic cyclopropanol carbocation is the smallest aromatic compound now let us look at this one cyclopentadienyl anion which has six pi electrons this also has a delocalized by electrons therefore this also aromatic when you look at this compound it has six pi electrons however does not have the d localized pi electrons since you have the here ch2 therefore this compound is not aromatic on the other hand when you look at this one the cyclo hepta trinal carbocation and this is also has six pi electrons the pi electrons are delocalized therefore this is aromatic this has 10 pi electrons it has the d localized pi electron therefore this is aromatic the four compounds are aromatic and this compound is not automatic because of it lacks the delocalization of the by electrons now let us look at this problem the major product of the reaction of two bromobutane with sodium ethoxide is
So when you react with sodium methoxide it can produce a mixture of alkene say u2 elimination on the other hand if you deprotonated this hydrogen and you will be able to form a mixture of two butane and if you look at the ratio of these compounds
So this will be the major compound and when you compare these two alkenes this is a more substituted alkene
So this compound will be produced more because of the stability of this alkene compared to this one and now we have to look at here you have the trans as well as cis alkene among this and this will be the major compound this can be explained through the neumann projection if you draw the neumann projection of this two bromobutane if you look at these two confirmations this is more favored and because it is less sterically hindered and this maintains the anti-periplanarity it can lead to the formation of the trans olefin on the other hand this can lead to the formation of cis olefin because of this and this will be the formation of this trans olefin will be higher and this reaction this reaction proceeds via e2 elimination for e2 elimination the anti-periplanarity of this hydrogen and here is essential and when it can easily undergo u2 elimination to give this

alkene as the major product in this although a mixture of alkenes are produced and this two substr this e alkene will be the major product compared to z alkene in summary we have seen problems related to us analysis we also have seen the use of halo form tolerance and fillings test which are commonly used to find out the functional group halo form test as just we have seen is used to find out the presence of methyl group which is bonded to the carbonyl group when we react with sodium hypo halide it can be oxidized to copper's legacy and hello form tolerance and fillings test are used to find out the presence of alien functional group tolerance reagent can be prepared from the silver nitrate sodium hydroxide and ammonium hydroxide solution when you mix and you will be able to form a silver complex which can oxidize aldehyde to copper slick acid where silver one will be reduced to silver zero and similarly welling solution which can be prepared from the copper sulphate and sodium potassium salt of tartaric acid which can be used to find out the presence of aliad group already will be oxidized to copposic acid where the copper two will be reduced to copper monoxide as red brown precipitate we can easily find out the presence of already functional group using this tolerance and failings reagents then we have seen the aromaticity for a compound to be aromatic it should satisfy four aspects should be planar should have delocalized pi electrons should have a four four n plus two pi electrons and should be cyclic then we have seen the chemoselective reduction of nitro group if you have dinitrobenzene you can try to selectively reduce one of the nitro group using sodium sulphide we have seen an example then we have seen the aromatic electrically substitution we have seen several reactions for example nitration of nitrobenzene the nitration takes place at the meta position whenever you have the electron withdrawing group the electrophilic substitution takes place at the meta position on the other hand if you have the electron donating group the reaction usually takes place at the para and ortho positions we have seen one example for the alkylation if you have the isopropyl chloride you can try to react with benzene in the presence of lewis acid like aluminum chloride we have seen the preparation of cumin which can be oxidized to cumulative peroxide using oxygen under heating the cumulative peroxide can be converted into phenol and a stone by treating with acid this is an industrial process we use to prepare phenol similarly if you have the alkyl halide you can try to react with benzene via aromatic electrophilic substitution which is known as spiritual crops alkylation similarly you can also try to if you have the acid anhydride acid chloride you can carry out the oscillation which is known as spring crops oscillation you can carry out this reaction using lewis acid like aluminium then we have seen the hydration of alkenes and alkynes you can reverse the stereochemistry if you carry out the reaction with water the pressure acid you will be able to form the more substituted alcohol as the product on the other hand if you use the hydroporation oxidation you get the left substituted alcohol as a product if you have the alkene you can convert into alcohol using these approaches similarly you can also alkyne also can be reacted with the water and the acid to give enol which will be converted into ketone depends upon the nature of the alkyne similarly you can also react with bulky borane to give the addition compound which can be oxidized through hydros group can be converted into aldehyde or ketone depends upon the nature of the substrate then we have seen the hydrogenation partial hydrogenation of alkyne using palladium charcoal which is which reduces alkyne into alkene the presence of quinoline which is known as lindler catalyst which can be used for the partial hydrogenation of alkyne to alkene you get the cis alkene as the product you can also convert into tron sulkin using sodium liquid ammonia the reaction is studious specific then we have seen an example for elimination reaction you will be under you will end up with more substituted alkene as the product then we have seen an example for the radical reaction if you have the peroxide which can react with hydrogen halide to form a radical species which can undergo addition reaction with alkene to give the alkyl halide as a product i hope that this presentation will be useful to you with this we conclude this lecture thank you very much you