

hello everyone in the last class we started with the reactions of alcohols and we saw that what are the different ways in which alcohols can react the reactions could either be due to the hydroxyl functionality involving the replacement of the hydroxyl group or those in which the hydrogen of the hydroxyl was getting replaced which were due to the acidity of the alcohols then we were discussing further about the reactions where both the alkyl as well as the hydroxyl group both are involved in the reactions and the first in this series which we took was the oxidation reaction the oxidation of alcohols to aldehydes ketones and acids

so these are the oxidizable functionalities and the oxidation can be carried out with very many reagents such as potassium permanganate chromic acid and these essentially were yielding us the corresponding acid

so this is what we saw last time that if you start with a primary alcohol and you carry out its oxidation with aqueous alkaline  $\text{KMnO}_4$  or with chromic acid you were ending up with an acid however if you want to stop in between

so the first step is that your alcohol is getting converted to the aldehyde and the aldehyde subsequently undergoes oxidation to the acid

so if i want to stop at the aldehydic stage what are my options

so one option is that i either distill off the aldehyde once it is generated or i make use of milder oxidizing agents which do not promote the further reaction which involves the conversion of the aldehyde to acid and one such reagent in this category which we started talking about was pyridinium chlorochromate

so today i am going to start with pyridinium chlorochromate as a mild oxidizing agent for the oxidation of alcohols

so the general formula for pyridinium chlorochromate the structural formula is given like this

so you have a pyridinium cation and a chloro chromate anion ok

so the first thing is that how is this prepared

so for this you take chromium trioxide and you dissolve it in hcl okay and this is followed by treatment with pyridine

so subsequently you treat it with pyridine and eventually you get your compound which is the pyridinium chloro chromate this pyridinium chlorochromate is taken in dichloromethane as the solvent and used for the oxidation of alcohols

so mind you we are dealing still with the oxidation of alcohols and in this series i am discussing the milder oxidizing agent like a pyridinium chlorochromate which can be used to stop the reaction at the aldehyde stage

so now if you start with a one degree alcohol and you treat it with pyridinium chlorochromate in dichloromethane you get the corresponding aldehyde

so you started with ethanol you will end with acetaldehyde

so the reaction stops at this place now you compare this with the oxidation with other chromium reagent

so you compare it with your other chromium reagents which we discussed last time if you do the same thing with the jones reagent we were ending up with the corresponding acid the reaction would not stop at the aldehyde stage now if you recollect what is

so special about pyridinium chloro chromate which is preventing the further oxidation

so as you can see here that the conditions which we are using are non-aqueous okay and the reason why the aldehyde was changing into acid with the other chromium reagents was that in these cases there was a dihydrate which was being formed from the aldehyde there was a dihydro generated from the aldehyde under aqueous conditions ok

so in the presence of water this is what was happening and this is what was leading to the further reaction

so since this is taking place under non aqueous conditions we are able to regulate the reaction and stop it at the aldehyde stage okay

so this is one important reason why pyridinium chlorochromate is used in specific conditions okay

so after oxidation now the next reaction involving both the alkyl and the hydroxyl group is the dehydrogenation of alcohols

so we are talking about the dehydrogenation reaction of alcohols which involves removal of a hydrogen as the name says you are removing a hydrogen molecule from the alcohol

so what are the conditions which means that if you start with a primary alcohol and you remove a hydrogen you will end up with the corresponding aldehyde and how are we able to do this reaction

so the conditions are quite harsh they take place in the presence of a copper metal at a very high temperature 300 degree centigrade and this is what leads to dehydration if you start with the corresponding secondary alcohol under the same conditions you will get the ketone with the release of hydrogen if you start with a tertiary alcohol for that matter it does not bear any alpha hydrogen ok there is no alpha hydrogen available with the tertiary alcohol and therefore there is no possibility of a dehydrogenation to take place and in fact this yields you the corresponding dehydration product

so you get a dehydration with the loss of water molecule from the 3 degree alcohol all right moving ahead another type of reaction involving both the alkyl and the hydroxyl part is what we just saw with the three degree alcohols is the dehydration reaction

so dehydration of alcohols which involves as the name says loss of a water molecule

so what are the different ways in which the dehydration can be affected we can either have chemical treatment of the alcohol

so we have chemical methods or we can have catalytic dehydration of alcohols

so in the chemical methods for dehydration you start with the alcohol and you carry out the dehydration in the presence of concentrated  $\text{H}_2\text{SO}_4$  or concentrated phosphoric acid

so these are the dehydrating and you heat it

so you are carrying out this reaction which is nothing else but it is a type of an elimination reaction

so it is an elimination reaction of an alcohol and this can involve a rearrangement if it goes via  $\text{E}_1$  pathway i am sure you have done talked about the substitutions and the elimination reactions

so under that you would have learned that  $\text{E}_1$  reaction just like in  $\text{S}_\text{N}1$  involves the formation of a carbocation intermediate and this is this carbocation which can undergo rearrangement to give you rearranged olefins the reactivity for the dehydration would follow the order 3 degree 2 degree and 1 degree alcohols this is the order of reactivity okay if you start with a tertiary alcohol with the tertiary alcohol you treat with sulphuric acid and heat it in this case you will get this as your only product okay

so this is uh the difference in the reactivity 3 degree being the most reactive as compared to 2 degree and 1 degree the other method of dehydration we said is catalytic

so for carrying out the catalytic dehydration the conditions involve essentially we use alumina at 350 degree

so you pass the vapors of alcohol ok you pass vapors of alcohol over alumina to bring about the dehydration reaction all right

so this is about it and we now take up another important reaction of alcohols which is popularly known as halo form reaction hello form reaction it is a

popular reaction of alcohols and the important thing about this reaction is that it is given by those alcohols which bear a methyl group

so you have to have a  $\text{CH}_3$  functionality

so if you have this functionality these are the ones which are going to respond to the halo form reaction

so what do we mean by that that means this reaction is going to be shown by methyl ketones ok

so these primarily are the substrates which are going to respond to a halo form reaction

so you have methyl ketone as a substrate you can have a secondary alcohol the condition is that this secondary alcohol should have one methyl group attached to this carbon during the hydroxyl because eventually during the reaction it is going to generate this methyl keto functionality which is a requisite for it to respond positively to halo form reaction you can also have primary alcohols which again during the reaction are able to furnish acetaldehyde or ethanol which again has the  $\text{CH}_3\text{CO}$  unit

so it is given by methyl ketones it is given by secondary alcohols one of the carbons is bearing the methyl it is given by primary alcohols the carbon is next to the the carbon which is bearing hydroxy the next carbon is a methyl carbon and it can also be given by acetaldehyde and this is the only aldehyde which will give a positive haloform reaction okay

so what is this reaction and why are we

so specific for these substrate

so in the haloform reaction you take the compound you treat it with the halogen this halogen could be chlorine bromine or iodine this is done in the presence of an alkali and what you get is the corresponding halo form when you use chlorine product is chloroform when you take bromine you get the corresponding bromoform if you take iodine you get the corresponding iodoform chloroform and bromoform are colorless liquids while iodo foam is a pale yellow solid ok this is a pale yellow solid and that is why this reaction is popularly known by the name iodo foam reaction

so for all the different halogens it is the iodine which is the most important to for this type of substrates because you get a solid compound which is iodo foam which is yellow in color easily you can see that and you can conclude that this particular molecule contains the  $\text{CH}_3\text{CO}$  functionality all right

so what happens in this reaction with the alcohol this reaction requires three steps if you start with the alcohol as the substrate the first step is the oxidation the second is the halogenation and the third is the hydrolysis

so if you start with an alcohol in which the carbon bearing the hydroxyl has a methyl attached to it then it will involve an oxidation followed by halogenation followed by hydrolysis but if you directly start with an aldehyde which is acetaldehyde or a ketone bearing which is a methyl ketone in this case it will only involve two steps okay with these ketones it will only require two steps which are the halogenation and hydrolysis

so only two steps are required with the ketones because you do not need an initial oxidation

so if you look at the reaction the overall reaction let us see what happens with ethanol let us say we start with ethanol as your starting okay the first step is it is a one degree alcohol with the halogen under alkaline conditions it produces the corresponding aldehyde along with formation of  $\text{NaX}$  and water

so if you balance this you require two moles of  $\text{NaOH}$  to give you two moles of  $\text{NaX}$  and two moles of water

so essentially what is happening initially is that your  $\text{NaOH}$  and your halogen let us say it is a chlorine it is providing you the corresponding hypochlorite

so its a sodium hypochlorite and nacl and water this is essentially what is happening and this is the oxidizing agent which is actually responsible for oxidizing the alcohol to the aldehyde this is the first step which is the oxidation the second step is halogenation in which once you get the corresponding acyl functionality in the presence of halogen and base all the three alpha hydrogens of the aldehyde or the acyl unit all the three alpha hydrogens are replaced by the corresponding halogen and you get this kind of a product along with formation of nacl and water

so if you balance this you require three molecules of halogen three of naoh to give you three of sodium halide and three of water this is the second step which is the halogenation involving complete halogenation of the alpha hydrogens the third step is the hydrolysis of this trihalogenated compound under alkaline conditions and this yields you the corresponding product which is your halo form

so this is what your halo form is along with formation of h<sub>2</sub>co<sub>3</sub>

so if i write the overall equation for all the three steps the oxidation halogenation and hydrolysis i write combine all the three steps

so my overall equation for an alcohol halo form reaction becomes that one molecule of alcohol will react with four molecules of the halogen and six molecules of naoh to yield the corresponding one mole of haloform sodium formate five moles of sodium iodide and or sodium chloride and five moles of water

so this is the overall balanced equation for a halo form reaction involving an alcohol the same thing if you carry out with an acyl unit okay if you do the same thing with an acyl unit

so what is the first step the first step in this case is going to be directly the halogenation using the halogen and naoh to give you the halogenated ketone along with formation of sodium halide and water again if you balance this it requires three moles of this three moles of this stoichiometry and this is what we get the second step is the same which is the hydrolysis of the halogenated ketone and you treat it with naoh again one mole and you get your haloform along with formation of sodium salt of the corresponding acid

so overall the equation for the halo form reaction of acyl ketones would involve the following stoichiometry you start with one mole of acyl ketone and treat it with three moles of halogen and four moles of naoh

so this is a stoichiometry requirement of the base and the halogen in the haloform reaction you end up with the haloform and sodium salt of this acid three moles of nacl and three moles of water

so you can see the difference when you are using starting with this the requirement of the halogen and the base is lesser obviously because of obvious reasons the first step is not involved here which is the oxidation okay

so this is the overall equation reaction for the halo form reaction if we look at the mechanism the mechanistic steps in little more detail

so the first step is the oxidation and the oxidation is by the presence of the halogen and the base which is forming the sodium hypochlorite and

so this we already done the first step you are generating this ok the second step is your halogenation now in the halogenation you are having a carbon next to a carbonyl which is electron withdrawing carbonyl and each of these hydrogens the alpha hydrogens is slightly acidic because of the presence of the carbonyl adjacent to it

so in the presence of the base what happens is that the base comes and abstracts this proton

so that you get an intermediate which is next to a keto

so this you know is nothing but an enolate

so you are generating an enolate which is a stable species here you can write this as the resonant hybrid structures for this enolate

so you get this enolate in the second step enolate or your carbonylic form of this compound is what picks up the halogen

so you have your halogen which is slightly polarized and it picks up this enolate and what you get is the corresponding mono halogenated product okay you get this monohalogenated product and then this subsequently undergoes halogenation twice with two molecules of halogen and finally it gives you the trihalogenated compound

so this is happening three times successively in the halogenation step

so that finally you get the trihalogenated product which undergoes hydrolysis in the next step

so you have this trihalogenated ketone which in the presence of the base the base attacks the carbonyl ok and you have three electron withdrawing halogens attached to this carbon and thus attack of this hydroxyl

so eventually this loses the  $\text{C-X}_3$  functionality and you get this molecule and this abstracts this proton from the acid

so there is a proton transfer it abstracts the proton from the acid and gives you the corresponding halo form

so you get the halo form along with the formation of the corresponding carboxylate anion which can again take up the proton to give you the acid

so the importance of this reaction if you see the application and the importance of this reaction is that it can distinguish those aldehydes and ketones which aldehydes is only acetaldehydes it can distinguish those ketones and alcohols which have a  $\text{CH}_3\text{CO}$  unit or which are capable of generating the  $\text{CH}_3\text{CO}$  unit in case of alcohols it is also used for the preparation of chloroform bromoform and iodoform

so these are used as a local anesthetic this is a general anaesthetic and this is an antiseptic

so it is used for the preparation of these compounds

so this is an important reaction I would also like to comment on the substrates which would give a positive haloform reaction and substrates which would not respond to the halo form reaction despite of having an acyl unit

so let me show you few examples if you take acetic acid and you subject it to iodo form reaction you do not get any yellow ppt ok it responds negatively to this reaction likewise if you take another acid derivative you take acetamide you take acetyl chloride acyl chloride or you take the methyl ester each of these give a negative iodo form test

so in general we say that the acid and acid derivatives other than ketones okay and aldehyde is your acetaldehyde they do not give positive iodo form reaction

so now you rationalize and think why is this happening

so you recollect that we are carrying out this reaction under alkaline conditions

so if you have an acid this is the most acidic proton of the acid ok

so under alkaline conditions what is going to happen this is immediately going to give you the corresponding sodium acetate it is going to yield you the corresponding anion which is quite stable and this is not going to

so this is already a charged species the molecule is already charged now

so now the deprotonation of these alpha hydrogens is going to be very very difficult also there is going to be problem in the last step in the hydrolysis step

so what is happening in hydrolysis

so we just saw that during the hydrolysis the base is attacking the carbonyl but in this case even if you know you are forming the halogenated product the base is not going to abstract is not going to attack on the carbonyl but rather it is going to pick up this acidic proton and form this

so you already because you have a carboxylate ion in the system right  
so the nucleophile is not going to come and attack on the carbonyl anyhow  
so this is the reason why an acid will not work out positively iodo foam  
reaction and on the similar rationale you can imagine why an acetamide will also  
not work under these conditions again this amidic proton is relatively acidic  
and it is going to give you again this two resonating structures and it will be  
incompetent not capable of pursuing further the iodo foam reaction in case of an  
ester however the first thing this is going to hydrolyze under alkaline  
conditions and yield the corresponding acid and then the same problem which we  
witnessed here with the acid is going to become evident here as well because it  
is because of the reason why even the esters would not respond to an iodo foam  
reaction but if you take the compounds which have active methylene groups ok  
active methylene compounds the dye keto compounds if you take this compound and  
you carry out the iodo form reaction this is

so between this alpha hydrogens and these two alpha hydrogens of the active  
methylene  $\text{CH}_2$  since the active methylene  $\text{CH}_2$  is more acidic

so it is going to give this particular halogenated product during the  
halogenation step and then this is followed by attack of the alkaline and as  
expected ok you will get this corresponding anion along with formation of acetic  
acid and it picks up this proton and it will give this product

so with active methylene containing carbonyls this reaction will go likewise if  
you have instead of a ketone you have an aldehyde at these two terminal  
positions even this is going to give a positive iodo foam test just the way we  
have seen with this active methylene compound ok

so this is about alcohols their reactions the important reactions we have  
covered halo form reaction although it is a reaction of the acyl compounds the  
ketone the methyl ketones but again it is very important for alcohols as they  
can be oxidized under the haloform reaction conditions to the corresponding  
methyl ketones

so now moving ahead we have talked about the monohydric alcohols now we will  
talk about the dihydric alcohols or glycols

so if you recollect in the first few lectures we talked about the synthesis of  
these glycols right

so if we want you know an alcohol which has two hydroxy groups adjacent on  
adjacent carbon atoms that is what we were calling glycols and we are talking  
about different methods of synthesis starting from alkenes

so now we will go little more descriptive on these glycols and the important  
reactions they undergo in today's class ok

so we start with glycols which are dihydric alcohols and the general formula is  
this

so you have two hydroxyls on two adjacent carbon atoms and we can have  
different types of these glycols if you have both one degree you call this as  
ethylene glycol we talked about even the physical properties of glycol has been  
talking about if it has more than one hydroxyl group what is going to be the  
impact on the boiling points of these molecules by virtue of the hydrogen  
bonding if you have a secondary alcohol here linked to a one degree alcohol this  
one two three carbon

so we call this is a propylene glycol ok if you have another example  
you have a three degree alcohol and this is linked to this one degree ok

so you have a two three four carbon system and if you have to start numbering  
it is a one two one two diol and it is a two methyl two methyl propane one two  
diol ok

so you have many different examples of glycols which you can have if you have  
suppose both the carbons as tertiary carbons ok which are bearing the hydroxy

group both are tertiary carbons

so this is an example where both the hydroxy groups are present on the tertiary carbon atoms these kind of diols are called pinnacles pinnacles are those diols in which both the carbons are tertiary carbon atoms okay

so if you have this is a phenyl phenyl phenyl phenylphenyl and ah diol

so this pinacol is called benz pinacol this is a common name and if you have to give the iupac name it will become 1 1 2 2 tetra phenyl 1 2 diol let us move on to the synthesis of these molecules the glycols

so one of the ways you can have different starting materials ok

so the first one as we discussed as i was telling you in the previous classes was starting from alkenes as substrates and if you recollect please check back the notes we started with alkenes as substrates and we said different methods for synthesizing diols one was using aqueous or alkaline  $\text{KMnO}_4$  and if you remember this was giving us a cis dihydroxylation ok this was a cis dihydroxylation the same thing was happening with osmium tetroxide which on which one or treatment with of alkenes with osmium tetroxide was again giving you a dihydroxylated product you could also make an epoxide out of an alkene followed by an acid catalyzed hydrolysis which was also giving you an alkene and another example ah method and strategy which we discussed was with the hypohalous acids followed by hydrolysis if you recollect and just write it down in case you do not remember you had an alkene you treat with the hypohalous acid ok and what was happening a regular addition reaction on alkene electrophilic addition and this was followed by hydrolysis

so you carry out sodium carbonate hydrolysis and this yielded the corresponding diol

so these were the different methods which we discussed for carrying out the synthesis of the diols starting from alkenes as substrates ok the next method for the synthesis of diols is starting from alkyl halides right

so from alkyl halides the conditions which are employed are you carry out the hydrolysis simple hydrolysis with the carbonate solution okay which means that you have to have a dihalide to begin with right and you treat it with sodium carbonate aqueous conditions you get the corresponding diol along with the formation of sodium chloride and release of carbon dioxide however the disadvantage with this reaction is that the yield of the diol which is obtained is poor

so it is not frankly speaking a very good method

so a revised version of this method would be that you start with the same dihalide the dihalo compound and you treat it with fused sodium acetate ok treat it with sodium acetate this is an alternate route and you end up with the corresponding diacetate which is a glycol acetate and this under acid catalyzed hydrolysis furnishes the corresponding glycol in high yield

so this is an improvised version of the hydrolysis of the dihalides for obtaining these one two diols ok the third substrate from which you can get the diols is from alkylene diamine

so we started with alkenes then alkyl halide and now alkylene diamine

so alkylene diamines you have to convert this into a diol ok this is what you want from it

so what is the immediate thing which comes to your mind what reagent should we use

so we treat this with nitrous acid for the amines treatment with nitrous acid is what is prescribed you treat it with two moles of  $\text{HNO}_2$  which can be formed from  $\text{NaNO}_2$  under acidic conditions and you will get this diol along with release of nitrogen gas and water

so this is another method for synthesizing the diols starting from alkylene

diamine another method is as we did previously also reduction of the carbonyl compounds give alcohol simplest of all

so you carry out in this case also reduction of various carbonyl compounds and in this case the preferred choice of reduction is that we carry out electrolytic reduction electrolytic reduction of the carbonyl compounds

so if you start from glyoxal which is the dialdehyde you carry out electrolytic reduction you get the diol the same thing can also be achieved starting from the diester which is the diethyl oxalic acid ester

so oxalate again you can carry out the same thing this involves loss of two molecules of the alcohol you can also do get the same compound starting from half aldehyde which is glycol aldehyde to give you this glycol if you have a keto and aldehyde group which is a pyruvic aldehyde this is also susceptible to electrolytic reduction to give you the corresponding 1,2 diol

so all these different methods for the synthesis of the one two diols all involve the starting compound as a carbonyl functionality

so now we proceed with the reactions of glycols and as we did previously for monohydric alcohols the reactions can be broken up into categories one due to the hydroxyl group ok and others which involve both the alkyl and the o h group in the hydroxyl group you can further differentiate those which involve the hydrogen atom loss and those which involve the entire o h group replacement

so as we did previously for the alcohols the reactions involving the hydroxyl group you have the action with sodium metal which involves the acidity of these diols since these are dihydric alcohols

so obviously you will expect to get a monosodium and a disodium salt

so all these reactions are nothing but we have done earlier also for alcohols but just a recap or maybe for you to know that it works the same way with diols as well

so you take the one two diol the only thing we are showing here is it takes place sequentially one by one

so at 50 degrees let us say lower temperature conditions you replace the first hydrogen and then for removing the next hydrogen from the diol you have to elevate the temperature and this is how you get the disodium salt this is when you have both the hydroxyls as a one degree alcohol if you start with a mixture of a one degree and a two degree you will expect some preference of one over the other depending upon the relative acidity of the two hydrogens of the hydroxyl

so this is a one degree and this is a two degree

so when you do this reaction with the sodium metal you will expect the primary alcohol o h to get replaced this being more acidic we discussed earlier and this is followed then by the replacement of the other hydrogen of the secondary alcohol to give you the disodium salt

so this is the reaction involving the active hydrogen atom of the diol and it gives you the monosodium and the disodium salt

so another reaction of the diols is with acids alcohols on treatment with acids give you esters diols are no different

so you will end up with a monoester and a diester

so it depends upon the stoichiometry of the reaction the conditions temperature everything and this will decide whether you will end up with a single product which is a diester completely or you end up with a mixture of a mono ester or a diester

so that depends upon the stoichiometry of the reagents the reactants and the conditions employed

so you treat it with acetic acid and you treat it now with another molecule of the acid and you get the diester another reaction is with acetic anhydride and this is what leads to acetylation of the alcohols

so you start with glycol treat it with acetic anhydride in the presence of pyridine and you get the diacetylated compound all these are reactions also known with alcohols there is nothing new which we are studying except for the fact that these are now involving diol system with halogen assets this also we have done previously for monohydric alcohols there is a slight difference

so if you recollect with halogen assets we talked about treating it with hcl hi hbr and i was telling you how with hcl we call that is the lucas test you know how that is going to precipitate out and tell you whether it is a primary secondary or a tertiary alcohol

so here also if you start with a glycol and treat it with hcl 160 degree centigrade loss of water molecule you get a mono substituted mono halogenated product and with another equivalent of hcl relatively higher temperature 200 will give you a dihalo compound

so this is with halogen acid the halogen acid being hcl or hbr this is the reaction which it gives but if your halogen acid is a hi then the rules are slightly different in fact the product is slightly different

so you treat it with h i ok

so i can directly write two moles of h i two of water lost

so you end up getting this as the product but this is quite unstable and is not isolated immediately undergoes d halogenation and it gives you the corresponding olefin

so if you start with a diol and treat it with h i instead of getting the corresponding diiodinated compound you get the corresponding olefin and this is also true if you also take pi3 instead of hi

so basically it is the diiodo species which is not stable it leads to the formation of this product okay another reaction in halogen acid if it reacts ah so halogen acids and if it reacts with nitric acid then what happens this we studied earlier also

so you now have the diol and you are treating it with nitric acid which is

so since there are two hydroxyls i'll use show it with two molecules two moles of the nitric acid and i end up getting this dinitrate along with loss of water

so these are straight forward reactions dealt with earlier also with pcl5 pbr3 what will happen to the diol what was happening to your monohydric alcohol same thing will happen here also

so you treat it with pcl5 you will get the corresponding dichloro compound important reaction in this category would be the reaction with diols with aldehydes and ketones these are important reactions aldehydes and ketones

so with aldehydes and ketones the diols end up giving us acetyls and ketels as products these acetyls and ketels are the cyclic compounds and the carbonyl is protected in the form of acetyls and ketels when we carry out the total synthesis or in multi-step synthesis

so in this case this is what is used to protect them if you have to carry out deep protection protection selectively then we convert an aldehyde into an acetyl

so you treat this with the diol okay

so sequentially two steps loss of water and you end up getting this compound the acetyl and the same thing if you do starting from ketone then you again lose water one molecule of water to give you the corresponding ketone ok

so these are important reactions because this is one of the base in which an aldehyde and ketone can be protected

so it is used in protection d protection strategy another reaction of a diol is a dehydration which is again an elimination reaction and there can be very many different conditions in which it can be dehydrated to give you different kinds

of products

so either you directly heat it without adding anything or you add any dehydrating agent like a zinc chloride anhydrous zinc chloride or you treat it with phosphoric acid or you treat it with concentrated sulphuric acid

so different types of dehydrating conditions can be used if you heat it if you add zinc chloride if you take phosphoric acid if you take sulphuric acid

so if you simply heat a one two diol at high temperature you end up getting the corresponding epoxide

so an epoxide is the product from a diol if you are heating it without any added reagent if you do the same thing using zinc chloride and you heat it it again undergoes loss of

so it gives you  $\text{CH}_2$  double bond  $\text{C}-\text{H}$   $\text{O}-\text{H}$  loss of water here also all these are dehydration reactions but happening in different ways and this gives you vinyl alcohol unstable product and it immediately rearranges to give you acetaldehyde

so you get acetaldehyde if you treat it with dehydration with zinc chloride okay the other reagent is phosphoric acid ok in phosphoric acid we start with two moles of your corresponding glycol dehydration loss of water molecule but look at the link the linkage is between one of these ethylene linked together and the other hydroxyls are free

so what you get as a product is a die ethylene glycol when you carry out this dehydration with phosphoric acid as the reagent and the last one in this series if you start again with two moles of this and you treat it with concentrated sulphuric acid it undergoes now loss of two molecules of water instead of one as was happening with phosphoric acid and in this case the product which you get by the loss of two molecules of water is this cyclic ether which is called dioxane it is a popular solvent used in organic synthesis

so this is ah what happens when we carry out dehydration under different conditions

so we get an epoxide we get an aldehyde we are getting a dioxane

so all these different strategies are what makes this very interesting and in the next class we are going to take up few more important reactions of these glycols we will talk about one of the important reactions i can talk about is the pinacol pinacol rearrangement this is what we are going to discuss in the next class

so stay tuned and revise what all we have done

so far thank you you