returning to our discussion on carbon nitrogen bonds or nitrogen containing organic compounds one very important thing i have not yet talked about is the stereochemistry of the compound and stereochemistry plays such an important role in the biological activities that one stereoisomer is found to be medicine the other stereo isomer maybe even poison that sort of biological difference is being observed now if you look about the structure of two compounds where a carbon nitrogen bonds are being shown this is the alpha bond here also the alpha bond the substituents is the beta substituent with a ortho chloro thing this compound if i put a mirror in between these two isomer then what i see the left hand side is the mirror image of the right hand side and if i take it and fix it on the object that is the first one that is not superposing because carbonyl will be on the left hand side and in this case the carbonyl is on the right hand side so the handedness is different so this type of compounds which are non superposable mirror image relationship will be called the enantiomer so one compound having the s ketamine say plus specific rotation the other compound is r ketamine having minus specific rotation or vice versa but one is found to be anaesthetic like s ketamine and look at the biological properties of the other one that is hallucinogen so just by changing the orientation in space one compound is found to have one type of biological activity the other compound the other enantiomer is totally different so stereochemistry control stereochemistry maintaining and to know that absolute stereochemistry is very very important not only the the compound is ah whether will be biologically active or not or if active what type of biological activity it will get another important thing sometimes we ask that all the time people talk about the chirality where carbon is being present as if carbon other than carbon the chirality can not be there it is not correct but again some compounds we find where the chirality is coming from other atoms say nitrogen chirality center if i take a compound where nitrogen having the lone pair of electron tetradel the port is the lone pair of electron stain and three substituents being shown here as a cartoon pink red and green and if the other enantiomer being written again this is the mirror image of that super possible so these two are enantiomer but if we look at the nature of this compound we do not see any sort of

enantiomers getting
separated out that is called amine inversion   what is that how can one amine could be converted
to the other amine very clearly being written   this structure is s p three hybridized
detected three groups are there r one   r two or three regular tetrahedron and the
fourth substituent is the lone pair of electron
 so this is getting converted in the transition
state to an sp2 hybridized carbon
 so sp3 to sp2   where the p orbital keeping the electron
pair and then it is reverting back either   coming back to the starting material or to the
other form where the nitrogen lone pair is below   the plane
 so what is happening this is the
inversion is taking place
 so amine inversion   is it very slow or very fast very common
knowledge says the inversion barrier is   only 6 kilo calorie per mole for our alkyl group
that is r one r two r three that would be alkyl   they can we convert it from one enantiomer to
another enhancement just by putting a simple   little energy at six kilo calories
 so they are
in rapid equilibrium
 so what is the problem   problem is you cannot catch one of this
enantiomer from this rapid equilibrium thing   whenever you want to get one it is getting
converted to other
 so overall thing will be two   enantiomers not being separable or resultant thing
is racemic
 so how to convert that this is the in   inversion barrier is very low another very nice
data is ammonia inverse 2 into 10 to the power 11   times per second unbelievable
 so you cannot
get that ammonia substituted ammonia in the   chiral form because whenever you are going to get
catch 1 it is getting converted to the sp2 and   then to the other form and
 so that is
 so rapid
equilibrium it is very very difficult unless   very low temperature and the energy barrier is
being imposed then and only then you can do but   there are tricks for other organic molecule
having carbon nitrogen that you can do it that is inversion becomes slow when nitrogen is
in a strained ring that is three membered ring   in that case like ammonia or substituted ammonia
that inversion will not be fast but it will be   slower why because three member rings mostly
sixty degree angle that biased strain as per   biostrain theory will be very very strenuous so

to convert it to the s p two hybridized form that   because from s p three cannot straight away go to
go to other sp3 it will have to pass through that   sp2 form sp3 to sp2 then another sp2 sp3 i mean
so these enantiomers of one two dimethyl aziridine   azideans are those compound where one carbon
nitrogen bond is present and three member ring   instead of carbon one nitrogen is there the
nitrogen is methyl substituted carbon is also   methyl substituted another is a free carbon
that is having two hydrogen atom
so this type   of enantiomer of one two dimethyl acidity den
hydridines are three member nitrogen containing   compound nitrogen is numbered as one
so n methyl
one position one methyl and two position the next   one is the another methyl
so enantiomers of one
two dimethyl azidine is very much being obtained
so one way to solve this problem is making
some bridge or making a small ring
so that   the inversion barrier is being imposed and that
is why one of the enantiomer could be separated
so that is the trick to get a chiral nitrogen
compound
so of course the answer i have already   given nitrogen cannot achieve a one twenty
degree bond angle as it is in a three member   ring sixty degree dihedral angle it will be
very very difficult and
so it will be remaining   in the chiral form the two enantiomer can be separated
so that is a very nice trick to get   the chiral nitrogen compound nitrogen atom is
connected to atom which are unshear lone pair of   electron like this if i put this picture in this
way then what is happening a three membered ring   with nitrogen that is a chlorine substitute and
in this structure also this methyl methyl this is   the thing this is not the chiral center because
symmetry is there that is methyl this is also   methyl but this is the chiral center where
nitrogen having chlorine having c is me and   another is the lone pair of electron and another
fourth group is ch2
so all four different groups   are there the fourth one is the lone pair of electron
so this is the mirror image of that and   this mirror image is not super possible on that so
this is a also two pairs of enantiomer which could   be obtained which could be separated and which
could be used for purposes
so one trick is making   small ring then the nitrogen inversion could be
stopped but if it is acyclic ammonia derivative   very very difficult because the interconversion

is very very fast one more example is here that   is stroga's base where a benzene ring with carbon
nitrogen carbon carbon is there its symmetrical   two bench endings and there is a bridge between
two nitrogen atom through a methylene group this   type of bridge drink structure are very important
so triggers basic also could be obtained in a   chiral form because here the flipping will not
be possible or in other way the interconversion   of the normal to the pyramidal nitrogen will not
be possible because of the strain in the molecule   or bridge in the molecule which the conversion
of s p three to s p two will be stopped another very interesting feature look this
thing very carefully if we have a x y bond   sometimes x is keeping the negative charge and
another resonating form it is coming over here   and the one of the bond getting localized or
polarized to the y group
so negative charge   is shifting from x to y or y to x what we call
this type of phenomena double headed arrow in   resonance
so these are two resonating
structure in one case x is the nucleophile   in other case y is the nucleophile it will be
very clear if i if you look at this in this box   there are two compounds are there one is our
preferred one that is nitrile c triple bond n   where carbon is the negative charge that is the
nucleophile or c double bond n minus that is   another pair of electron is with this carbon
so that is the nitrogen is the negative charge
so when a species having a negative
charge not localized but delocalized   sometimes with x atom sometimes with the y atom
so it can bite as if with several teeths are there   to the substrate which is positively charged
that is c plus that sort of phenomena   or that sort of nucleophiles are called
ambident nucleophile ambient nucleophiles we   know nucleophiles negatively charged or non bonded
electron pair which can donate to the substrate   nucleophiles which are more than one generally
two or more suitable atoms through which they can   attack the substrate they are attacking the
substrate means they are attacking the ah positive   end of the substrate
so negative end should attack
to the positive end and how that thing will take   place and who will control that whether x will
attack or the y will attack and what we call that   type of species x y d localized we call it ambidex
nucleophile and i will show you a very nice   example where you can control the attack either by
carbon or by nitrogen by changing the environment   or putting some catalyst look at this rbr
treated with silver cyanide this is very much   carbon nitrogen bond related

problem alkyl bromide treated with silver cyanide you get a slow process any alkyl bromide methyl bromide ethyl bromide etcetera treated with silver cyanide a gcn what will form it will form silver bromide which precipitates out we know the silver nitrate is a good reagent that sort of thing will take place silver nitrile is silver is monovalent and at the same time the rbr will get polarized to r plus and c n minus fine and this reaction follows very fast pathway to get r n c look at this c n minus is being written in the third bracket but the product being shown that it is r n plus and c minus that means the r plus getting attacked by the c n through the nitrogen not to the carbon that means nitrogen is the attacking species whereas just simple change the same alkyl bromide when treated with sodium cyanide nation what we see we get rcn so this type of thing is called nitrile this type of thing is called isonitride so totally two different type of mechanism is taking place in this case when we are using silver cyanide we are getting one type of product which follows substitution nucleophilic unimolecular reaction which is being written here very clearly as sn1 type and in the second case it undergoes a we have discussed about the substitution nucleophilic bimolecular reaction that is a transition state no intermediate gets involved so it gets r b r and c n coming in this fashion so c is the because whenever cyanide is being produced c is the negative end and that carbon attacks to this r and you get rcn so there is no question of any isomerization or any stepwise process here it is a transition state mediated process we know a reaction which goes through transition step only is sn2 type a reaction which goes through an intermediate that means first transition state then intermediate then second transition state then to the product we call it an sn1 type so why silver is doing that sodium cannot answer is silver plus promotes the formation of r plus by the formation of a g x because that rate of reaction is very fast silver reacts with x very quickly and that generate the r plus whereas sodium cannot do that so nucleophile attacks from the site in which it has more electronegative atom very clear answer what is that the nucleophile is c n whether c minus or n minus that will have to know answer is as silver promotes the formation of r plus by the formation of silver halide a g x is being formed x has been

taken care of
so r plus
is there nucleophile attack from the side in which it has more electronegative atom out of carbon
and nitrogen which one is more electronegative nitrogen
so obviously it is not getting
any chance to rearrange
so you get rnc is the product think very carefully silver
plus promotes the formation of power very fast by the formation of silver halide generating
the nucleophile to attack normally what is that the more electron negative side should attack
first more electronegative out of carbon and nitrogen is nitrogen
so nucleophile attacks from
the side in which it has more electronegative atom
so you get rnc by sn1 mechanism
whereas sodium plus does not show such promotion for the formation of r plus because
compared to silver sodium plus is very normal it does not take part the precipitation that rapidly
so what it does it has a normal sn2 type reaction that is a transition state where carbon because in
cyanide n a plus c n minus the negative charge is on carbon now
so carbon gets directly attached
to r through the transition state like this and you get rcn
so very nice take one you can get
rcn if you want to get rcn follow sodium cyanide if you want to get rnc follow silver's salt this
has been used in number of other cases like rbr silver nitrite hgno2 slow process silver bromide
then first process r o n o very very nice that is you know two acting as r o n o
we took n o two plus yesterday and we found that n o two could be reacted in way ah o n o
so n o two minus is this case where it is an ambition nucleophile it might attack
through nitrogen it might attack through oxygen when it is an sn1 case more electronegative
atom is attacking the same phenomena same logic when it is a rbr sodium nitrite or potassium
nitrite k n o two case then we get a transition state and the product is being obtained as r n not
r o r o n o this is r n o two totally different compound by changing the inorganic component
from silver to sodium one is following sn1 mechanism another is giving sn2 type mechanism so
this is a very nice role of ambident nucleophile ok ah i said about carbon nitrogen single bond
carbon nitrogen double bond and very nice case of an ambient nucleophile as carbon nitrogen
selectively carbon could be attacked to the substrate that r or nitrogen
could be attached to the substrate r now another type of thing very much helpful
because how you can convert now amide to amine by hofmann degradation reaction

i mean to a
mine that i told you if you want to make some amine from nitrile r c triple bonding how
can you do that basically nitrile is this and amine is rch2 nh2 what is difference here
this triple bond has been removed to single bond and two hydrogen being added to each carbon and
the nitrogen atom that means two hydrogen being added to the triple bond to convert that c
typical bond n to c h two n h two that is primary amine or one degree amine
so that process
will be called hydrogen addition or reduction
so reduction of any of these functional groups
by catalytic hydrogenation or another very good reagent is lithium aluminium hydride mixed hydride
lithium hydride and aluminum hydride l h 3 and l i h together l i l h 4 that yields an amine this
way if you take an oxygen oxymps are double bonded n o h group is there oximin
so it is called oxime
when you reduce that thing you end up with rch nh2 that means auxins are often reduced with
sodium metal in alcohol that is another reducing agent system sodium alcohol potassium alcohol
that is also being used
so to make the amine not necessarily you will have to do simple sn2 type reaction you can start from a triple bonded thing follow stepwise reduction or one ah step both the
bonds getting reduced
so one way is by hydrogen or lithium aluminum hydride another way starting from nitrile or oxime you can make primary amine or in this case very nice example r c o n r prime
double prime amide you can get primary secondary or tertiary amine very nicely as per your desired
as per the substituent
so another trick or another technique to get the amine from the nitride is by reduction and reducing agents are hydrogen generated in situ or lithium aluminium hydride
sometimes other hydrides could also be used i said about antibiotics and the discovery
of penicillin one of the very simple molecule where carbon nitrogen bond is no doubt
present but again a sulfonyl group is also present these compounds are also found to
have antibacterial property that was the first discovery of the antibacterial properties
of certain compound in nineteen thirty six from the louis pasteur institute in paris a
sulphur neelamite look at this terminology sulfonylamide sulfonyl sulphonyl means so2 amide
is nh2 and in this case there is another amine group in the four position sulfonylamide was found
to be the first sulphur drug there are many use of sulphur drug not only antibacterial activity but
other thing in the following years many thousands of structural variation of

sulphur nilamide were synthesized in the search of additional drugs so this is also a very nice breakthrough in the case of sulphur melamide or sulfonamide thing discovery proto alkaloids i said about some of the alkaloids another very important important alkaloid is mescaline a paid dream that is being used for treatment of coal condition caffeine caffeine is almost every day we use in tea or caffeine that has a very nice structure you can say that right handed the six member ring is peridine type but in the three position there is another nitrogen atom likewise the right hand type is a pyrrole so it is a pyrrole pyridine combined but again in the three position there is another nitrogen so one pyrrole moiety another peridine moiety somewhat different oxidation state this side is the two carbonyl group this is nothing but caffeine caffeine is obtained from tea dust caffeine is found in coffee and many other things and it has ah painkiller activities it has medicinal activities of other type and ah to certain extent it is addictive also so conicin is another alkaloids i have some more structure where the alkaloids have been classified depending on the structural features present like if i ask what type of alkaloid is this one answer should be piped in because pyridine is this when reduced form is bipyridine what type of structure is this that is pyrolytine propane is another nice compound one example i gave you quinoline is a benzo pyridine isoquinoline the nitrogen position is different in quinoline it it was one now it is in two position tetrahydroisoquinoline means one ring is fully reduced that means saturated indole that the thing i told you already indole with another indole making indigo with some substituent of the carbonyl group that is nothing but benzo pyrrole that means a benzene ring and a pyrolynic that is the five member links are there imedazoles are the building blocks of the proteins or amino acids many compounds that is one and three position there are two nitrogen atom it is a five member ring that is imidazole and purines is one and three position exactly like this that is pyrimidine type thing and one one three that is immediate type thing so pyrimidine imidazole together is giving a very important class of compounds in the building blocks of life many material is purine so all these are nothing but carbon compounds having nitrogen or carbon nitrogen bonds are there ok these are some of the natural sources where

from you can get the alkaloids some pictures are being shown just to get the however the coca
leaves or other things yeah i did not say about another very simple compound look at this this is
a pyridine being attached to a pyrrole very simple nothing else but pyrrole is somewhat reduced by
reduction of the pyrrole moiety what we have got we have got a new chiral center it was not there
if it is pyrrole there is no chiral center the compound is not chiral but when you reduce it and
you get a cardinal center and you exclusively that be the hydrogen beta then one type of enantiomer
if hydrogen alpha that will be another type of enantiomer
so nicotine is a nicotine is also being
present in all those ah beverages and many ah narcotics activity is also there and
nicotine is very good as a stimulant also these are nothing but again some example of carbon
nitrogen compound that is nitrogen containing organic compounds arycholine in methyl but
there is a substitution in the three position with coochh3 sometimes one thing should come to
your mind and most of the example what we are taking that is pyridine in the three position
there is a substituent why not in the two or four position answer is very simple biologically
or the biosynthetic pathway by which these compounds are being produced they follow
the pyridine three carboxylic acid path that means nature is producing exactly in that fashion that
is why mostly three substituted case in case of pyridine or substituted pyridine are the
natural products but people can synthesize in other position as in this case this is the
two position substituted protein that is called loblin lobeline could also be prepared by the
similar method ok now i will show you some of the interesting reactions of the carbon
nitrogen bond let us take this example if you have and c h 3 c h 2 in h 2 let
us take this compound as a 1 degree amine one thing is there the next to the nitrogen the
first carbon is called the alpha carbon the second carbon is called the beta carbon
so this is a one
degree amid because cnh2 that nh2 is three and there is a beta hydrogen being present in
this molecule
so if you treat with excess of methyl iodide what will be the product
think you have a beta hydrogen substituted ethylamine treating with excess of methyl
iodide
so what methyl iodide will do will pick up the lone pair of electron from nitrogen and break the carbon iodine bond
so as a result you get n ch3 one hydrogen getting

expelled out with the help of iodide and then in that way if you do the further methylation you
end up with trimethyl alkyl ammonium iodide that means the quaternary salt n plus and i minus
now one very nice discovery was done by hofmann what is that if this type of compound where
a quaternary nitrogen is there counter ion may be halide that is b r minus or iodide minus
treated with silver oxide in presence of water you get the tri methyl alkyl ammonium
hydroxide fine now this compound when heated then what will happen we mentioned that
there is a beta hydrogen present in this compound then it is found that if it is heated
with mild base or little bit of in water that picks up this proton that is beta hydrogen
and the electron pair forming bond between carbon and hydrogen shifts towards the next carbon as a
result the nitrogen which was positively charged have been thrown out of the system
so what you get you get an alkene this type of reaction is known
as hofmann elimination reaction what is elimination reaction when two groups
leave the system at a time their relation may be alpha maybe beta may be gamma or delta for omega
that type of reactions will be called elimination reaction what is the driving force here the
hydrogen getting picked up by the base and the n plus with three bulky groups or methyl groups is
the quaternary salt
so that bond will be much more labile or very easy to break
so that is one living
group and hydrogen is the other leaving group as a process you are getting with the alkene
this is an example of hopman elimination reaction cyclohexane methyl trimethyl ammonium
hydroxide if you take this example and do an o h minus what will happen again
with respect to this n plus this is the alpha carbon this is the beta carbon you
can take this side also no problem you get the this is this will be the gamma but when
beta hydrogen is present then that will be the preferred one
so what it will do it will shift
over here and break that carbon nitrogen bond that will be eliminated as dimethyl amine
and you get the c 6h by double bond ch2 i think you have seen this type of
reaction where an alkene is being produced and then in the difference here compared to the
other things what you have seen that you get the alkene mostly in the more substituted position
but in this case you are getting the alkene in the less substituted position why this difference
this type of products are called hofmann product and the where more substituted alkene is
being produced is called the set check product and for hoffman product the n

alkyl or cotton
result of n alkyl is very important that is why you have picked up this example over
here
so this is a nice way to make the alkene in a less substituted site
so this
is a hopman reaction or hopman product now in quaternary ammonium hydroxide that have two
or more non equivalent beta hydrogen look at this what do you mean by non equivalent beta hydrogen
so this example there is a beta hydrogen over here there is another beta hydrogen in this
side
so what will be the product how you will be able to identify the product rule is
in quaternary ammonium hydroxide that have two or more non equivalent beta hydrogen non equivalent
beta hydrogen means this is alpha this is beta this is alpha this is also beta
so this is one
type hydrogen this is another type hydrogen
so far the example i took earlier there
was only one beta hydrogen as in this case yeah here there is only one beta hydrogen so
there was straight forward no ambiguity was there but when there there are two beta hydrogen
then which one will be the major product you will have to analyze it and to find
out an answer the major product results from abstraction of the more or most acidic beta
hydrogen acidic protons will be very easy to lose because acid is a proton donor
so which proton is
more acidic that will be easy to lift the system if there were be two beta hydrogen as in this
case which one is more acidic that will leave the other one will not leave or if it leaves it
will be less in amount in this case it is very clear that ch3 that hydrogen what is happening is
more acidic whereas this more substituted ch3ch3 is less acidic how did i say that answer is very
simple because these two methyl group donating electron to the carbon
so electron density of
this carbon is getting increased whereas here only three hydrogens are there no methyl groups
are there only one post is from other side that is they are common to that
so obviously the electron
density on this carbon will be more than this one and when the electron density is more then
obviously the hydrogen will be less acidic so more acidic hydrogen will be the less substituted
one and you get the major product as this one that is why hopman product the chemistry regio means
region which region the double bond will come in that terminal one less substituted one or the

more substituted one that is with the swedish   product or the hopman product in hoffman product
again if there be two beta hydrogen which one will   be selectively eliminated in the elimination
reaction answer is which one is more acidic   because more acidic will be easy to leave
how to know which one is more acidic   what sort of other functional group or
electron donating or electron withdrawing group   is present that you have to calculate and
check and static factor also comes in the   in the rescue and it says that this is more
acidic
so you get major product as this one i will tell about another interesting feature
right you know one very nice elimination reaction   when an alkyl halide say ethyl
bromide being treated with   alcoholic alkali ethanolic koh what is the product
you get an elimination reaction if you treat that   same alkyl halide with strong alkali what you
get the corresponding alcohol that is an sn2   type reaction
so in a beta elimination reaction
that is if we take an inoxide what is that n oxide look at this transparency essentially
a variation of the hopman elimination   the cope starts with a tertiary amine oxide
what is a tertiary amine that is all three   two hydrogen and the sub substituents
are there there is no free hydrogen   and when this is being oxidized the lone pair
of electron of the nitrogen has picked up the   two minus
so it is the n plus or minus
so this
type of compounds are called inoxide a tertiary   in oxide white tertiary because this nitrogen
all the substituents are there no free hydrogen   what it does because of the proximity next to
this carbon that is alpha beta this carbon this   carbon having a hydrogen atom o
minus will pick up this hydrogen   the carbon hydrogen bond shifts over here and the
carbon nitrogen bond breaks
so it i can say it is   a hopman type reaction hofmann type elimination
but extra thing is o minus is picking up that   hydrogen that acidic hydrogen and making a
almost a cyclic transition state to give a   product which is nothing but an alkene and ending
dialkyl hydroxylamine this type of reaction was   studied by cope from his name it is known as cope
reaction one new terminology you can see here   syn elimination what does mean by syn elimination
the hydrogen and nitrogen whatever the groups are   they are leaving the system from the same side
that is the s y n sin means from the same side c's   or if they leave from the opposite side one very

important thing is the two groups what it leaves are anti to each other if it is a cyclic
compound it is very anti means opposite and opposite of anti is seen sin means the same
side the two groups are leaving
so that is why this terminology seen is being written over here
so another example is shown that is cyclohexayl methyl dimethylamine oxide two methyl oxide o
minus will pick up the same way the beta hydrogen and the carbon hydrogen bond electron pair
shifts over here the carbon nitrogen bond breaks and you get almost exclusively 98 percent of
methylene cyclohexane
so these are the advantage of the carbon nitrogen bond formation or carbon hydrogen bond breaking to make new compounds over there i will now take you to some of other
interesting case of the carbon nitrogen chemistry let us start with a compound where we have
a structure like this look at this structure benzene with another binding means naphthalene
in the one position there is an oxygen if that be oxygen with hydrogen that is called alphanaphthal
but other than that there is a ch2 choh ch2 nh chch3ch3 a long carbon chain ending with a
isopropyl group
so this compound is found to have a heart stimulant or it is a very
good heart stimulator very simple compound if i ask you how one can prepare this
compound because it is a carbon nitrogen compound or nitrogen containing organic compound
how to prepare answer is when you are adding look this part whenever you want to find some way out
it is better to break the molecule in such a way
so that you can make it very easily and
what you see this portion is ch3 ch ch3 two n h being replaced by n h two
so c h
three c h c h three n h two being treated with some compound and i should say n h two is
the negative end
so the some other compound that means some other site where the
carbon will be the positively charged this concept making carbon positive nitrogen
negative is from the knowledge from the experience and this is dependent on the latent polarity and
as i told the other day the terminology is for the synthone these are the synthone carbocation
or nitrogen anion these are the synthone
so if that be the synthol what is the synthetic
equivalent what is the starting material answer is simple epoxide is the starting
material this is a very stable compound and another answer is ch3ch ch3 nh2 is the second
component
so this is starting material number one this is starting material number

two if we treat them together they should undergo exclusively one type of thing
you know this type of compound is called epoxide ethylene oxide epoxide
so epoxide when treated
with a nucleophile where it can attack it can attack over here and open up this carbon oxygen
bond or it can do the other way around means it can attack to this carbon and break this
carbon oxygen bond which way it will take place solid arrow it will take place the broken
arrow it will not take place how did i know very simple answer whenever this type of
reaction is nothing but a sn2 type reaction whenever a nucleophile attacks a substrate and
if it is an sn2 type reaction the living group and the nucleophile should be in one
line or 180 degree approach angle this is number one that could happen over
here also this side also but during the that process you get a transition state where almost
carbon is pentavalent means very much crowded
so what the nucleophile will prefer for an sn2
type reaction a less substituted carbon and if you look very carefully this is chch2 and this is
only ch2 that means here there are two hydrogen here there is only one hydrogen
so that is the
reason the less substituted side will be attacked less substituted side will be attacked then you
end up with this compound then question come how come such a big molecule you can prepare answer
is not big if you break it again you end up with o c h two c h double bond c h two from this how
did i write again cutting the epoxide in this way taking off the oxygen then if i ask you
how can you convert a c h double bond c h two to an epoxide your answer will be
i have to get an oxygen which is positive o plus because c h double bond c h two attacks
an o plus oxygen which is positively charged what is the source for oxygen positively charged
that is the reagent it may be hydrogen peroxide as simple as that peroxide linkage is there or
it may be one very nice reagent is power acid power acid means a carboxylic acid is
coh a per acid peroxide linkages oo linkage will be there cooh in this case
the two oxygen are not equivalent why because one oxygen being attached to carbonyl
another oxygen being attached to hydrogen
so this type of peroxide linkage is needed for the
oxidation of an alkene to the epoxide and it is the o plus which gets picked up an obvious reason
will be this oxygen will be picked up and this c o o will be converted to the coo minus and
you end up with the corresponding epoxide

so this is a very general rule that type
of phenomena why selectively one oxygen of the hydrogen peroxide or metal chloro
per benzoic acid or part benzoic acid or per acetic acid gets picked up the answer
is this is the alpha effect nucleophile what is that terminology if two heteroatom in
this case oxygen oxygen may be with sulphur or nitrogen or other thing being linked together
the electron pair forming bond between them are not equally shared the one which
gets the lines here is the nucleophile and one which leaves its air is the electrophile
that electrophilic oxygen will be picked up by the electron rich alkene to make it epoxide ok you
can look at this and say that this is also very awkward looking molecule how to prepare
that not much difficulty as i told you you should break it in such a way
so that you
can make it very easily i did not break it over there i just broke it over there the idea
is the two component in this case will be a naphthalene derivative with a o minus
over here and a c h two c h double bond c h two with a plus on that side why i did
not put oxygen plus or carbon minus the answer is oxygen is more electronegative
so negative charge will be more stable and carbon is more electropositive so put the positive charge on the carbon
so what is the these are the synthone what is the
synthetic equivalent o minus k plus you can put it and the corresponding ion you can put the bromide
ion this is nothing but allyl bromide very standard compound commercially available
so when
allyl bromide is treated with alpha naphthol the reaction is very simple o minus will
attack this carbon throw away the bromine and you get o c h two c h double bond c h
two not at all difficult
so a simple trick can help to get a complicated structure to be
synthesized very easily by this pathway and i will tell you one more
interesting feature over here that is if i write a structure
like this a benzene ring with a carbonyl in h with another carbonyl and ask you
what sort of compound is this one ah we have seen this type of compound that
is benzene ring with two carboxylic acid group side by side that is one two dicarboxy
benzene or dicarboxylic engine when that is being heated it forms an anhydride and the
aniodite being treated with ammonia you get that type of imi
so that is called this
is again carbon nitrogen bonds are there that is called thalimide p h t h a l i m i
d thalimide thalamide is very interesting compound in that sense the gabriel

thalimide synthesis that we have studied in textbook so it could be this hydrogen is very much acidic very much acidic with the help of a base or mild base even you can generate the n minus and this n minus can react with many compounds say one example i right now showed say allyl bromide it could attack over here and can be connected to that group in c h two c h double bond c h two so many compounds in that way could be prepared by using the thalamide what is the advantage the advantage is this hydrogen is acidic why because if you take off this hydrogen if you take off this hydrogen the remaining thing that is the conjugate base is nothing but this n minus plus h plus one very general rule is which one is stronger acid sometimes you have to answer say benzoic acid and phenol after the loss of proton from phenyl we get the phenoxide ion we can write three four resonating structure whereas for benzoic acid after the loss of the proton the benzoit anion we can write two symmetrical resonating structure that is very important the contribution of symmetrical resonating structures towards resonance hybrid is maximum and because of that the proton loss will be much easier when the stability of the conjugate base is more so that is the reason why benzoic acid is stronger than phenol likewise this compound will be also stronger acid the reason being it can have a symmetrical resonating structure where the electrons are getting delocalized on both side one this ones this carbonyl another to that carbonyl now if i at this stage if i ask you another very simple question and of course i will give you the answer instead of these if i write a structure this o that is sulfonyl being attached to n h can you guess the acidity of this proton or strength of this compound so far as acid strength is concerned it is unbelievable because this proton is lost so easily why because after losing the proton the remaining portion that is so2 this side so2 that side the nitrogen atom the having the lone pair of electron gets delocalized in number of symmetrical resonating structure more the symmetry both the stability more symmetric resonating structure of anions how this anion is being produced by the loss of the proton that is the conjugate base conjugate base if a conjugate base is very stable obviously the loss of proton will be facile and it will be unbelievable this compound is found to have an acid strength of 12 normal like concentrated hydrochloric acid and this type of carbon nitrogen system have been utilized because sulfonyl sulphur having d

orbital it
can hold the electron for longer time it can be localized and it gets stabilized by in in the
previous case you have two carbonyl now in this case you have s ososo4 eso s double bond o bond so
that is why more symmetrical structure more time to spend the electrons over there and more the
stability more the stability of the conjugate base means stronger acid and one important thing is
what is the most electronegative element known your answer will be fluorine and if by any way we can make this type
of compound very simple one this is doable and people have made it s o two s o two n f we can take this fluorine this fluorine being attached at this stage is
not electronegative it is almost electropositive i will tell you how if i bring some species
like o minus l i plus that is called enolate what happens this picks up that fluorine and
breaks the fluorine nitrogen bond exactly the way it picked up the hydrogen it can pick up
this protein and the remaining thing is so2 so2 n minus because this is very stable
and as a process we are getting the co and f fluorine being attached
so this type
of reaction is called electrophilic unbelievable electrophilic chlorinating agent
or electrophilic chlorination
so electrophilic proteination is a very offshoot
or very interesting feature which is coming from the two carbonyl thing being extended to
two sulfonyl pathway
so this is the acid strength over there ok ah i will tell give
you some problems what you can do if you are not able to do next time i will give you
the answer predict the product number one if aniline is the substrate treated with bromine
and water what product will you get second problem if thalimide right now i wrote that one c
o c o n minus k plus is the substrate being treated with benzyl bromide c six five ch2 br what will be the product and that product is treated with koh and water
heat what will be the next product third problem if i take a ketone coch3 and treat
with ammonia nh3 in presence of followed by hydrogen and nickel and under pressure and heat it what will be the product and
the last one i should say is c triple bond n having these being treated with hydrogen nickel
and heat what will be the product all these things i have discussed during this ah two three
hours lecture of now four hours you should be able to answer if not i will give you the answer in
the next lecture thank you very much and enjoy you