hello everybody i am professor j k ray of iit
kharagpur in connection with our discussion on nitrogen containing organic
compounds today
we want to recapitulate some of the terms and then proceed to see how carbon
nitrogen
compounds have invaded in the field of antibiotics color chemistry and many
other field in
details ah as i started yesterday with a very lucid definition of organic
compound because
people still believe in organic compounds mean that it is coming from the
living sources but if we look at the literature we
will find very interesting things look at this long ago in 1780s organic
compounds
obtained from living sources and inorganic compounds obtained from non-living
sources
so this
was the definition and everything whatever organic is to be used to come from
living
sources in 1828 the pioneer work of polar the first synthesis of urea by
hitting ammonium
cyanide is the remarkable work in that sense if you count the number of
nitrogen hydrogen carbon
and oxygen in ammonium cyanide and that of urea you will find the same number
of nitrogen hydrogen
carbon and oxygen atoms are there
so it is some sort of rearrangement but this is fantastic work
in that sense because the ammonium cyanide was prepared from inorganic sources
so from inorganic
sources we are getting the organic compound without using any vital force
so that was the
first breakthrough in the definition of organic chemistry that is chemistry of
carbon compound
that is why i said yesterday it is the carbogenic compound and then of course
many many
total synthesis partial synthesis and other synthetic methods have been
discovered where the biological systems or the living sources are not needed
so that vital
force theory is now in that way is abundant because earlier urea people used
to get from urine
and now people can synthesize very easily by the work of two very pioneering
chemist one is haver
you know the haber synthesis of ammonia that is nitrogen and hydrogen in the
catalytic condition
and this ammonium salt is very good fertilizer and that produces lots of ah
food needed in
the field from the field and the revolution has started in that way
so this ammonium
cyanide to urea is the first synthetic work then question comes ok organic
chemistry was
earlier a vital force theory without living sources organic compounds cannot
be obtained but
now look at the literature and can you believe how many organic compounds are
there a 2001 survey
was found 16 million that is also not optimized how many more are possible sky

is the limit the
total number of compounds coming out every day from laboratories industries are going in number
and
so sky is the limit is the better to call that
so many compounds will come and
from that as our topic today is on carbon nitrogen bond or nitrogen containing
organic compounds means now carbon compound
so carbon nitrogen bond is a must and look at
the urea molecule it has the carbon nitrogen bond c o n h two n h two or c o n h two hole two where
there is a direct bonding of carbon and nitrogen and life is organic chemistry though it came from
the vital force theory organic chemistry is the chemistry of the compounds of carbon that's why
i said that carbogenic terminology is much more ah perfect to define the carbonic organic
chemistry here there are some controversy that where what is the origin of life is it the
organic molecule that is carbon containing thing methane carbon dioxide or the inorganic
things like ammonia hydrogen and water and there are many controversies but people believe that all these gases under electric discharge like lightning generated some highly reactive species which in turn produced amino acid formaldehyde
hydrogen cyanide purines pyrimidines which are the building block of the life
so origin of
life came from again this carbon compound
so we organic chemists believe together with some other
gases the beginning or origin of life came from carbogenous material as simple as
carbon dioxide methane etcetera i yesterday said about the carbon
nitrogen bonds importance in very industrially important compounds now if you look
at the structure this is the tricolour inside that there is a benzene ring with a pyrrole unit pure
unit means five membered nitrogen containing thing exactly it is collect connected by the other
half only thing is the carbonyl is up over there and the carbonyl is down over there in
between there is a carbon carbon double bond
so this type of structural feature is
present in a very interestingly important and important for many purposes that is called
indigo an organic molecule contributes to freedom struggle how come it is coming what is the freedom
struggle how this organic molecule is doing a role if you look at the literature you will find
during british period especially the in bengal then what happened the indigo planting
was forcefully done by the british people why because the blue dye is very very popular in
europe and to cultivate indigo the planters had to forego their food

production they are forced to
cultivate indigo and then what happens the farmers they did not get lot of money
so they were forced
to cultivate indigo then question come what is indigo that structure i showed and it is on the
top over there that it is nothing but benzopyrol we call it indole another benzopyral indole and
two carbonyl groups are there
so this type of simple molecule being isolated from indigo plants
by lot of extraction procedure why not people can make it by simple chemistry it was undertaken by
lot of chemist all over the world and fortunately robin in uk he first discovered a method for the
synthesis of indigo and from that time slowly the indigo cultivation was stopped and people now can
do anything and ah no need of forcefully doing that one thing came to my mind why the indigo
is needed or the blue color thing is needed to make a white cloth brighter why not yellow
green red
so many colors are there i am sure you also think that why the blue color that is robin
blue or nowadays people call about ultramarine and crystal violet that sort of coloring
thing why this blue is needed to get a white clothes brighter think and you find the answer that is
in the white color it is the combination of vivjor violet indigo blue green yellow orange
red and if we keep some white things exposed or for longer time what you see some dust dart and
other things because of light ultraviolet and visible the yellow stain is getting developed
that means the strain what is getting developed is yellow in color now to make it brighter
what you need you need the complementary color
so what is the complementary color of yellow that
is blue
so blue being added that is robin blue or ultramarine then you are getting it brighter
so that is very interesting ah the thing that blue is the complementary color of yellow as dust
dart making the white cloth or whatever garments little bit yellowish in color
so to suppress that
the complementary color technology giving it blue second question comes why the indigo why not some
other thing answer is very simple if you look at the structure of indigo it has benzopyrol another
benzopyrol connected by a double bond double bond cannot be rotated it is a restricted rotated thing
so what is happening that is a long conjugated one benzene ring through a carbonyl another period
ring to another benzene ring that electron flow is taking place
so because of this long electron

flow the compound is becoming colour i say it in this way if the gap between the ground state and
excited state is minimized by the conjugation then what will happen you need less energy to take
the electron from ground to the excited level as a result what will happen the frequency
also will be less and wavelength will be more greater the wavelength brighter the color or
deeper the color and intensity of the color thing is like this 200 to 400 nanometer is ultraviolet
400 to 800 nanometer is the visible range
so that is the reason why conjugated
compounds more conjugated compounds are coloured and one of this good example is
indigo which is a benzo pyrrole or indole another benzo pyrrole or indole connected together
to make it long conjugated thing which is blue in colour that we all know and we use it and there
are some literature that time was published during the nil movement especially in bengal when the
people were fighting that they will not cultivate nil they wanted to grow more food
so many ah
literature came out and people agitated that was one of the famous literature dino bondhu mithras
nil darpan that was also translated in english so that era is no longer needed now that problem is
solved because synthetic chemists have solved this problem by making it in the laboratory now the
industry is producing in towns to make the demand another important coloring matter is the chlorophyll simple question is why the plants
around us we see green in color answer is very simple because of
chlorophyll the answer is written there but what chlorophyll does it not only provide
a green color to the leaves but it does a very important thing and if you look
at the structure of chlorophyll you will find there are four pyrrole units
i told the other day that poor pyrrole unit making a cavity and inside the cavity when a metal ion is fitted as per the size of the cavity as in the case of chlorophyll it is the magnesium the two nitrogen with the covalent bond and
another two by the coordinate covalent bond bind it and it makes a template where lot of
other substitutions in the pyrrole units makes the compound a specific color in this case it is
the green in color and chlorophyll is important not only to make the leaves beautiful or green in
color to absorbs light from sources it converts the carbon dioxide and water to the carbohydrate
that is glucose or sucrose etcetera
so very general reaction is 6 carbon dioxide plus 12 water
plus photons that is the light coming from solar sources is converted to c six h twelve o six that
is glucose fructose etcetera in aqueous solution and oxygen gas and six water

liquid more or less
balanced equation
so from carbon dioxide and water by the help of light energy glucose oxygen and
water is being produced i was again wondering why not we are able to produce the carbohydrate we
have carbon dioxide we have water we have light energy answer is we do not have chlorophyll within
us
so chlorophyll is doing that miracle to convert the carbon dioxide to carbohydrates by the help of
light and the chlorophyll that is a biocatalyst in that system
so it is not only for beautification
but also for chemical transformation being used and this is again a part of carbon nitrogen
compound carbon nitrogen compound i started with very simple compound as methylamine i
am now taking some more ah amines in details in general when people call that organic amine
means it should have a carbon nitrogen bond and if it is an amine
so obviously nitrogen
should be substituted the two with the hydrogen or alkyl group and if one of the hydrogen of r
nh2 being replaced by another r group then what is happening it was the primary or one degree
amine that is rnh2 because of two substitution one hydrogen is gone
so it will be secondary
amine that is two degree likewise the third alkyl group is getting entered with the loss of
the hydrogen from there
so it will be the tertiary amine
so amines like primary alcohol secondary
alcohol tertiary alcohol again could be classified as primary amine secondary amine and tertiary
amine i said about carbon nitrogen single bond carbon nitrogen double bond carbon nitrogen triple
bonded compounds and this is the amines of three types that is primary secondary and tertiary so
the r group not necessarily will be the alkyl it may be alkene it may be aryl also
so nomenclature
of these compounds being done as primary amine secondary amine or tertiary amine depending on
the substituents present with the amine group for the common name of simple aliphatic
amine let us do some exercise the alkyl groups on the nitrogen you have to count
and attach the term amine at the end suppose there are two groups then you put die or
prefixes that should be at the beginning ending with amine there are three alkyl groups then try
four alkyl groups then tetra in that way
so if i ask you can you write the name of this
compound whereas c h three c h two n h ch3 that means with the nitrogen one

methyl
one ethyl one hydrogen groups are there it may be called because this is again nitrogen
hydrogen only one substituent are there
so it should be two degree not primary i mean secondary
so people might call it ethyl methyl amine not
so good because e in the alphabet
comes first left hand side that is the ethyl group right hand side that is the
methyl group and overall it is the amine but that does not say whether the substituent is
on nitrogen or on carbon if the substituent is on nitrogen as it over here
so you should call it better n-methyl ethanoamine in methyl that means in methyl ether
namin is ch 3 ch2 nh2 one of the hydrogen being replaced by methyl
so n methyl ethanamine is
the good system or good naming of this compound likewise when nitrogen being substituted by three
methyl group nothing in there means methyl group carbon carbon carbon
so people commonly
call this type of compounds as tri methyl amine no doubt it is ok but again if you say the
position that where the methyl groups are there is it on carbon or is it on nitrogen you should
call it n in dimethyl methanamine because methanol is now clear that is ch3 in h2
so with that nh2
two hydrogen being replaced by two methyl group
so it will be called n in dimethyl methanomine
so if you read the front line one more time you start with the amine and before that mono dye
system you will have to put that is the prefix the systematic name is derived from the name of
the longest alkene that is the upsc journal rule the longest chain it find out name it present
by dropping the final e that is amines e and adding the suffix amine how then designate smaller
alkyl group as shown using the italicized locant that is nitrogen
so better to write the n in
italicized form italics form say in the first case it is n-methyl ethanamine in the second
case it is n-in dimethyl methanomine so practice with many such example from textbook
or any literature you will be able to do it ok if we take a step forward
from alkylamine to aryl amine in aryl amine what we see that aromatic amines are there yesterday i said about an aniline and its derivatives and its conversion to the
different form of different other structures
so aromatic amines are often named as derivatives
of aniline aniline is the basic compound nitrobenzene on reduction gives aniline and this
aniline should be called benzene amine benzene amine benzene amine
so that e has been removed and

amine have been put benzene amine benzene amine in methyl aniline if one of the
hydrogen being replaced by methyl so what should i call this compound in methyl
aniline very common terminology better term will be as per iupac system is
n-methyl benzene amine because the benzylamine is the parent system with
the nitrogen one hydrogen being replaced of aniline by a methyl group additional unique
common names when r is ch3 then you can call it r a ch3 in the para position
so people call
it a para toluene very common terminology that toluene is benzene with a methyl group in the para
position there is an amine group
so you should call it para toluene these are the trivial system
but very popular noun if r is a methoxy group och3 then it is called para anicidin
so these are also
very commonly being used in naming the compounds not only rigorous iupsa system but very common
and trivial and helpful ah terms still being used like paratoludine paranicidine in that way
amines not only are restricted to aliphatic and aromatic the amine may be a part of a heterocyclic
system as i showed the structure of chlorophyll the structure of indigo where benzopyrol or
simple polyperol units are there likewise the heterocyclic amine where heteroatom is a part of
the cyclic compound are some simple examples are pyridine pyrrole pipyridine and pyrolydine what
is the relation between pyridine and pipyridine one is the reduced form that is piperidine
the three double bonds have been removed by six hydrogen atoms and if you want to make
pipeline to pyridine what you will do you will have to dehydrogenate one very nice technique for
hydrogenation is hydrogen and for dehydrogenation normally sulphur selenium heating or even
palladium charcoal heating is good enough to take off the hydrogen and palladium charcoal can absorb
the hydrogen very easily that helps that catalyzes
so oxidation reduction phenomena makes pyridine
to piperidine and vice versa this is redox system likewise pyrrole where we see that is a conjugated
butadiene system and a nitrogen atom being there it should be attached to a hydrogen atom
so when
you reduce that p role that is n h c h double 1 c h single bond c h w 1 c h then come back to the nh
thing there should be hydrogen on the pyrolimoid if you reduce again what you end up you
get a pyrolydine that means hydrogenated pyrrole
so pyrolytine again on dehydrogenation
then similar pathway will produce the pyrrole now in general what are the properties

of the amines i said that amines are very much interesting compound because it is being
used to make dye to make coloring matters and other ah functional group transformation so
its physical properties also you should know that amines are moderately polar because rn
h2 group nh2 is electron rich r is only mainly alkyl or aryl
so that is the carbon
so it is
moderately polar because nitrogen having the non bonded electron pair it can pull electrons
between the carbon and nitrogens towards itself
so what happen because of the greater
electronegativity of nitrogen related to carbon and hydrogen this type of phenomena takes
place since primary amine and secondary amine that is one degree or two degree means having n
h bonds they can take part in another interesting feature that is that we call that hydrogen bond we
know mainly fluorine oxygen nitrogen we remember it in this way form but there are many other
elements also taking part in hydrogen bonding that is ah even carbon but very mild
so fluorine
oxygen nitrogen can take part in the hydrogen bonding
so when nitrogen having a hydrogen and
in the close proximity the donor thing is there
so do not accept that relationship will help so
what happens when you boil the you treat with water then you find that the nh thing getting
hydrogen bonded inter molecularly with the water one is intra molecular another is inter molecular
so because of inter molecular what happens because one aniline molecule is picking up number of say
water molecules its molecular weight is getting increased and because of that the association is
taking place greater the association greater the molecular weight and the hydrogen bonding is
helping in that way a very common question for inorganic chemistry is why a normal condition
hydrogen sulphide is gas but water is liquid the answer is this is the association takes
place much easily in water and h two s does not help in that type of hydrogen bonding
so that
is a case of inter molecular hydrogen bonding with the same molecule and intra molecular will
be a different type thing that will come later
so what happens if you look at the data the
tertiary means boil at lower temperature than primary and secondary but all amines can
have or can produce hydrogen bond to water
so why this difference making
low molecular weight i means water soluble how look at this table methyl

cyclohexane there is no carbon nitrogen bond cyclohexylamine there is a carbon nitrogen bond
but instead of benzene the middle ring is the cyclohexane and cyclohexanol here also no carbon
nitrogen bond but carbon oxygen bonds are there their molecular weight are very
close one is 98 captioning not and available is 161.
5 degree centigrade
why this difference and water solubility the we know the like dissolves like that
is the very general rule for the solubility we see that methyl cyclohexane having
carbon and hydrogen nothing else it is mostly organic compounds
so organic compounds
will prefer organic solvents
so it is insoluble cyclohexanol having the carbon carbon things
but there is an oxygen atom or alcoholic group which is a polar group which can take part in
hydrogen bonding but the methyl cyclohexane cannot
so its solubility is little that is
3.
6 g gram per 100 milliliter whereas aniline or cyclohexane i mean in this particular
case is slightly soluble the reason being same thing it is the inter molecular hydrogen bonding
which is helping to get it solubilized and there is some polar character getting coming up on the
cyclohexel amine that is carbon nitrogen bond amines versus amide if we now compare
amides are much less than amine even though their structural formulas both
so an
unshear pair of electrons appear on the nitrogen look at this amine rnh2 look at the amide rco
and h2 the nitrogen lone pairs are being shown pka of the conjugate acid that is a very important
factor to determine which one is more basic or more acidic or all this thing where amide is
found to be zero or amine is bound to nearly 10 that means it is the alkaline side when r is
alkyl say methylamine or ethylamine why this pka of the conjugate acid is close to 10 the
answer is the decreased base strength of amide is though it contains an nh2 group the amine also
containing an nh2 group but that nh2 is through a carbonyl group that is carbonyl and amine
together that is called amide carbamide beta and because of that what is happening the nitrogen
lone pair is coming in case of amide to make a carbon nitrogen double bond and at the same time
the carbon oxygen double bond is getting converted to the single bond that means a delocalization
of electron or resonance is taking place
so answer is the decreased base strength of amides
is very clearly explained by both resonance and inductive influence as with

aryl amine so
inductive effect means when r group is there which is electron pushing the electron density
gets increased and resonance effect as i told you that nitrogen lone pair is not on the amide now
it is going to the oxygen atom by delocalization through the help of carbon nitrogen bond
so carbon
nitrogen single bond getting double and carbon oxygen double bond getting single and the charge
separation is taking place and the oxygen will keep the negative charge
so that is the reason why
amides are much much weaker phase or than amine hoffman rearrangement this is the thing you have
studied because when i say the amide and amine then one question come can you convert an amine to
a mite or can you convert an amide to amine people started and there are many methods because if you
hydrolyze an amide you will get a corresponding carboxylic acid make a ammonium salt you get
thing you get an amide by acid chloride you can do likewise if it is an amide how can
you remove a carbon oxygen bond and make the r r and n attached together this reaction is very famous from the discoverers name the hoffman rearrangement is very popular
that is amines from primary amides primary amides are converted into amines by loss of the
carbonyl group as i told you that the middle co should be removed in between r and n h two by the
help of x two and sodium hydroxide what is x two mostly bromine and chlorine but other halogens can
do but bromine and chlorine gives better result
so what is happening it produces rnh2 and what
is happening the middle carbon that is being converted to sodium carbonate with the help of
sodium hydroxide and the the extra bromine or chlorine that is making the sodium bromide
so this
real element is called the hopman rearrangement of one degree amide provides one degree amine that
is primary amine everything being maintained with no contamination from second degree two
degree or three degree that is very important my primary amide is giving primary amine
no question of any conversion or changing or rearranging to the secondary or tertiary these
reactions can useful for shortening a carbon chain we know that in the homologous series if we
want to increase how to do that say rnh2 to we have to put some co very simple reaction is
being that co with the substitution and do a nitrogen nucleophilic co electrophilic reaction
i will tell you very simple question is aniline to acetone light how can you do make the

aniline with the help of a base to n minus treat with the corresponding c h 3 c
o group as h 3 social
so simple s n 2 reaction will take place you will get n
h c o c h 3
so aniline to acetone glide
so this type of reactions is very important which to minimize the number of carbon atom from
an amide just to get it converted to the amine i told that one of the very interesting reactions of amine is especially adelamine is the conversion of arylamine to the diazo compound and i also told that sodium nitrite and hydrochloric
acid in lower temperature at zero to five degree centigrade converts the aryl amine to aryl
digonium compound and this aryl diagonium compound with cuprus oxide i i said a general reaction c
o x and h x that is called sand meijer reaction but if you do it cuprus oxide or cupric ion
little bit in presence of water you get phenol cupress halide you get aryl halide halide
may be bromine chlorine iodine etcetera q plus cyanide you get aryl nitrile that is c
n k i arrive iodide all these things because number of functionality or functional
group could be introduced by this wave arylamine digitized to make the digium salt treat with fluoroboric acid you end up with the fluoride very very difficult
otherwise air f with phosphorus acid h3 po2 you get the simple benzene that is a very
common question being asked how can you remove the nitrogen completely in the hydrogen
very simple answer is hypophosphorus acid h3po2 which gives that proton to give it a r h so
these are some general technique to convert the aryl diagonal salt to the corresponding
substituted compounds its are start from functional group phenolic which halide
nitrile iodide fluoride hydrogen etcetera ok some biological importance
of course will have to every time to see what we are doing what we are studying what is the importance not only in the everyday life in the biological system also if
somebody asks you is the aroe means important or aliphatic amines important in the biological
field answer is many many because you can name thinking from the morning to evening how many ah
aryl amine derivatives are being used or you know one simple answer is two phenyl ethyl amine you
see benzene ring with a substitutions h two c h two n h two this should be called one position
is next to the nitrogen two position is the next carbon which is having a benzene ring attached
so it is two phenyl ethyl amine very important compound and these two phenylethylamine the
one position being substituted by a methyl and of course the hydrogen and if

we put the methyl
and hydrogen in this case you see very carefully methyl is with the broken bond that is called
alpha bond which means the below the plane and hydrogen is a thick bond which means beta bond
means above the plane and other two bonds that is the in plane bonds are carbon carbon and carbon
nitrogen
so in an s p three hybridize all the time will see as it is the regular tetrahedron
two one will be up another will be down and two will be in plane in plane bonds are being written
in normal lines above the plane with thick lines and below the plane with broken lines
so these are
the technology and amphetamine is a binge reading derivative bench redeem that means this type
of compound is also very much important having a medicinal value
so this type of compounds
are chiral chirality is very important when a general terminology people say when there
is a carbon having all four different groups and if i put a mirror i get the mirror image of
that and bring that mirror image and superpose on that it that does not superpose a super impose
we call these two isomers as enantiomer
so non superposable mirror image relationship is called
enantiomer but one restricted condition at this stage i am telling you that it should be all four
different groups and to fix the bonding this alpha beta things are very important one group is below
the plane another above the plane and remaining two are in plane being written in that way next
example adrenaline that is the hormone secretion nor adrenaline what is that here also hydrogen
and hydroxy groups are there and you have the amine that is nhr
so that means many hormones
steroids and other derivatives histamine dopamine all these compounds are amine
derivative
so yes answer is important amines having biological activities and that is very very important another example is serotonin and we we know not only this in
vitamins which is a vital force of life the pyridoxine is a vitamin b6 where we have a
structure where nitrogen is also being present or nicotinic acid where nitrogen is present
in the pyridine moiety and carboxylic acid group is in the three position there are three
carboxy pyridine anti histamine that is allergy people gets allergy because of the secretion of
histamine
so how to prevent that that is the anti histamines
so antihistamines are also

available and histamine is nothing but an alkyl amine ch2 h2 nh2 but it is in a pyrrole
unit there is one more nitrogen atom in the ring and there are many other example based on the
structural features and the biological activity so to make a long story short i can say yes aliphatic
and aromatic amines are very much important for biological system not only this this is just some
example there are plenty of compounds known which have been tremendous medicinal value which is
being used
so amines are very important class of organic compounds where carbon nitrogen bond
is present how to synthesize amine that i started with because carbon nitrogen bond will
have to keep other substituent may be hydrogen or oxygen etcetera simplest way to make
is by treating alkyl halide with ammonia or amide r n h two
so n h three plus r x what
will happen you get a salt that is ammonium salt r n is the plus x minus treat with a base
you get the primary amine one way of making that primary amine
so the nucleophilic substitution
of alkyl halides with ammonia is a very general method for the synthesis of primary amine where
instead of ammonia you can take rnh2
so that you get the substituted amine also the reaction may
be carried out in aqueous or alcoholic solution because solvent is needed to minimize the heat of
the reaction and to mix the components in a better way
so solvent has have been tremendous told not
only the control the appropriate temperature but also mix the component in proper way and then
water or ethanol very common solvent being used and solution of ammonia that is ammonium hydroxide is also available
so all the usual structure limitation
could be solved by a simple sn2 type reaction that is a primary alkyl halide one degree
treated with ammonia it undergoes a substitution what is being substituted the bromine being
substituted by nh3 plus and br minus
so this is the butyl ammonium bromide while the tertiary
this is the very important question why the tertiary bromide when treated with ammonia you
end up with iso beauty no amine being produced why i am giving you keeping it for you
to think when a primary alkyl bromide being treated with ammonia you get the butyl
ammonium bromide where nitrogen being attached while a three degree or tertiary butyl
bromide is treated with ammonia you get the nitrogen expelled out as ammonium bromide and you
get isobutene a simple carbon hydrogen compound no nitrogen no bromine why it is happening because of

the steric factor on this carbon in the first case is a nucleophilic substitution reaction the second
case to do that type of nucleophilic substitution reaction the steric factor is playing a role what
is that steric factor three methyl groups donated donating electron to the carbon which is being
attached to bromine electron density getting increased steric bulks also stopping the approach
of the nucleophile in this case ammonia to come opposite to the bromine atom so what
it does it can pick up the hydrogen of any of this carbon atom that is methyl groups
very easily because that is not statically blocked and at the same time throw the bromine
so when
in a reaction two atoms or groups are leaving the system at a time we call that type of reaction
is an elimination reaction if they are attached to the same carbon that is called alpha elimination
if they are attached to the next carbon one from one carbon second from the second one then we
call that type of is a beta elimination
so in that way gamma delta elimination reaction could be obtained
so in the first case it is a substitution in the second case it is the elimination so
very important and very nice way to make that from tertiary butyl i mean you want if you want
to make the i mean with ammonia you will not get why this is the reason because elimination is
much faster to stop the substitution reaction hydrolysis of amide a very important term
that is carboxamide amides are derived from carboxylic acid say if i ask you how can you make
benjaminite c six h five c o n h two your answer will be i will take the carboxylic acid benzoic
acid commercially available convert it to the benzoyl chloride by phosphorous pentachloride
or thermal chloride and treat with ammonia or you can do it in other way around that
is n phenyl benzemide if you take that is c o n h two sides there are two benzene rings and hydrolyze with hcl in presence of of course water
should be there and heat it you get the corresponding aryl amine salt that is it c six h five nh3 plus and the benzoic acid that means from the starting material what you
are getting you are getting ones type that is nh3 plus other is free carboxylic acid if you
hydrolyze instead of acid with the help of a base that is h minus in presence of water and heat
this thing what will happen to bench any light it will be converted to any link because it
will not be produced salt in the basic medium whereas the benzoic acid what was there in the
first case will be converted to the benzoyate because base will pick up the

acidic
proton coh that h is acidic proton likewise one very important ah i should say
the antibiotics came from this alphonamide thing
so sulfonamides are very important in the
field of organic chemistry that functionality sulfonamides hydrolyze much more slowly than
carboxamide but this is very interesting phenomena why but hydrolysis does occur under acidic
condition it hydrolyzes slower than that of carboxamide but hydrolysis does occur under
acidic condition these are very important question under basic condition the rapid formation of
an anion derived from the acid acidic hydrogen the the hydrogen atom being attached to nitrogen is acidic
so could be picked up very easily by base inhibits
nucleophilic attack and hydrolysis look at this r n h s o two a r p k a of that hydrogen is
close to ten treated with h c l water heat you get r n h three plus and a r s o three h
that means a r s o 3 h portion is not keeping that nitrogen but r is picking up the nitrogen
whereas when you are doing it in alkali medium so change of acid to base or base 2 acid is making
a tremendous difference in the product when you are doing it in h c l you are getting r n is three
plus a r s o three h like the previous case when you are doing it in which minus in water and heat
what you are getting you are getting an rn soar why this type of so2 air why this type of thing
is very special answer is sulfonyl s double bond o that can delocalize the electron pair of the
nitrogen to the oxygen not only one oxygen there are two oxygen in the top or the bottom and we
can write many resonating structure in this way
so this resists the hydrolysis why because
resonance more the resonating structure more the stability and when more the stable
stability the compounds reactivity will be less
so this resist the hydrolysis because of the
resonance stabilization
so very nice question sulfonamides hydrolyze much more
slowly than carboxamides why but this hydrolysis is possible under acidic
condition again why answer is very nicely given that if you treat with h minus you get the
corresponding anion where this nitrogen anion of the negative charge on the
nitrogen getting delocalized to the two oxygen atoms of the sulfonyl group and
another very important feature if we have a symmetrical resulting structure its contribution
is maximum because we cannot look at the energetically that is much more preferred when
you have two symmetrical resonating structure its contribution towards resonance hybrid

is much much greater than say five or six charge separated resonating structure why
because symmetry stabilizes the molecule ok
so let me take a step forward a colorful thing
that is cocaine if i ask you have you seen it somewhere or do you know the name answer is yes
it is the coca leaves which was first used as an anaesthetic for operation purpose but now people
also use it as a narcotics that is a bad use but it also blocks sodium plus channels with
lower affinity and specificity than tetradoxin
so it is a substitute for other medicine that is
a plus point and this is coming from some flowers and look at the structure why this type of
compound is important and why i picked up this thing i should say this type of compound
having medicinal value having a carbon nitrogen bond and a very beautiful structure one
side is cooch three that is an ester group another is o c o c six h five that is
also ester in the reverse direction
so that type of thing having a seven member
ring and a carbon carbon bridging through the help of nitrogen that nitrogen the
third substituent is methyl is cocaine and this type of compound should be classified
as an alkaloid why because alkali like nature nitrogen containing compound having
medicinal value obtained from plants
so all these things are being fully satisfied
so the compound will be called the alkaloid having some medicinal value ok another
interesting feature that ah organic chemist also cooperate with biologists nowadays people get
when get ill or sick they talk about the bacterial or viral infection what sort of thing has happened
some pictures i have taken from the literature and we see the doctors advice that if
you get a viral infection do not take antibiotics because this will not help you
but only it will give a secondary protection that means if in case because of weakness or because of viral infection you get weaker and bacterial infection
takes place that will be stopped by antibiotics
so one is a bacterial thing another
is a viral thing virus bacteria poliovirus this is the picture and
streptococcus that is the viral thing that is the bacteria oh these are the things
being listed by the doctors in many journals can you think of some illness caused by
viruses or caused by bacteria you know no doubt look look at the least least is sometimes
for bacterial infections are step throat gastroenteritis cholera tuberculosis food

poisoning all these are bacterial thing boys pneumonia acne what not ulcers and viral things
is also even the common flu is a viral thing aids colds hepatitis chicken pox all these are viral
thing ebola there are some common things also there might fit in both bacterial and the viral
side
so to kill those things viral things viral medicines are not much in the market but bacterial
medicines are tremendous that is antibiotics i said that one of the very important compound
of carbon nitrogen is not only that amino acid protein peptides but also the antibiotics the
first antibiotics which came in the market or peop many lives were saved was discovered
that everybody knows was by alexander fleming that is nothing but the penicillin i have got
some picture from the literature what shows that penicillin was discovered from the
fungus of penicillium noto term in 1928 by alexander fleming and alexander fleming
got nobel prize in physiology in the year 1945
so there are some photographs of flaming receiving
the nobel prize and playing doing this discovery do you know how this discovery was done and how
flaming came to the penicillin as a very good antibiotic to kill the bacteria if i look at
the next slide it will be very clear this was an accidental discovery on third september 1928
fleming returned to his laboratory having spent the vacation that is august on vacation with his
family before leaving it is a very interesting thing he had put his cultures of staphylococci in
a corner of his laboratory on returning fleming noticed that one culture was contaminated with a
fungus and that the colonies of staphylococci that had immediately surrounded it had been destroyed
you can see this one very clear all the things have been destroyed whereas the other colonies
this colonies grown further away were normal fleming identified the mould that had contaminated
his culture plates as being from penicillium genus and name the substance it released as
penicillin on 7th march 1929.
you see
so sometimes accidental discoveries are being made there are
many example one very nice example of that of flaming
so what we see that
penicillium fungus that one accidentally was contaminated because it was the petri dish containing agar agar jelly and this the bacteria where there was no contamination like
this bacterial growth is taking over that means no antibacterial effect was being found but in this
case the penicillium fungus surrounding that there is no growth of bacteria

so he analyzed what is
that contaminated thing and then found it is the penicillium thing and look at the structure
very carefully this is the actual picture this structure contains nothing but a nitrogen
carbonyl carbon carbon that is a four membered nitrogen containing organic compound that
is called beta lactam having of course other site there is a sulphur containing five membered
ring and n h with a substitution of benzyl thing
so what i mean to say the carbon nitrogen
compound i should say having tremendous potential as an antibiotic was first discovered
by flaming and there are many antibiotics nowadays people use penicillin cephalosporin all those
are beta-lactam antibiotics even monobacter simple beta-lactam no sulphur and other sites are
there they also have good antibacterial properties
so i will continue with other topics related
to carbon nitrogen bond little later thank you you