Heterocyclic Chemistry
Prof. D. R. Mal
Department of chemistry
Indian Institute of Technology, Kharagpur

Lecture - 02
Structure, Classification, Common Names

Many a times to give the better explanations, sometimes you need to speak in local languages, any case as the title says, today's topic is what structures classifications and common names. So, what you do today will basically we draw the structure, we talk about the structure when I say talk about the structure means structural features, and then there importance, their occurrence where are they define them I think I will begin with anthocyanin.

Anthocyanin will begin anthocyanin is nothing but pigments, the pigments of the flowers seasonal flowers for example, see most of the flowers, colors actually comes from these things. And then this structures what are the structures, structures basically I say flagon, flagon any idea what is the flagon, flagon there is no I see that not working only this one would be working fine.

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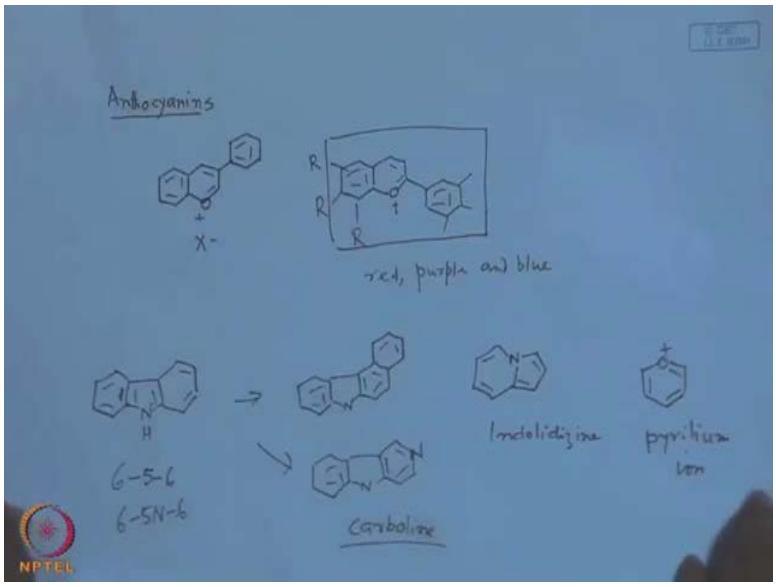

So, let us say begin with anthocyanin you will find the reference of this anthocyanin everywhere, almost any standard text book natural production chemistry every were. And they would look like the structurally the way I draw here is a 6 number drain,

another 6 number defuse together, and then there would be in oxygen in the backbone. And then the structures; obviously, as usual, but what you see here is oxygen iron, and then x minus and then some point I presume here on top there should be an aromatic nucleolus.

And this nucleolus could be on these oxygen side also oxygen side and quickly give you the actually the correct structures. So, this is basically the primarily structure and there are other kind of structures, so to look like again this and then you have the structures here the oxygen side there would be aromatic nucleolus, this is the basic structures. So, you have all possibility, but this one this one will be within the block is the right structures and then you have all kinds of the substitution patterns here and mostly the methoxy.

Because, this aromatic poly types they will have this nucleolus of this kind, so; that means, this colophons you can say actually are responsible for different kinds of the color, normally the colors could be red and purple and occasionally blue. So, you have then all kinds of the colors, they are actually due to this kind of colophons, and then there are other kinds of things. So, essentially what I am trying to say that this is the many, many diet organic diets, and the pigments are of hydro cyclic nature.

Then the other structures which should know rather we should we already talk about ((Refer Time: 04:04)) etcetera. Let us begin with one of the most smallest kind of structure for example, all of us know the this is the payroll this is name accepted all over the chemical literature. Then if you put the back bone, this is in enroll all of you know, but then what is this molecule and if you just complete this structure, since we know in our this is basically important backbone carbazole.

Then just writing structure is not enough, just you have to remember in terms of this structural features, how do you remember what are the features first should be remember that is important. So, you have all kinds which one we should remember first.

Student: ((Refer Time: 05:01))

I think I will go by him, but when you come to the normal feature it is the different thing, but when you talk about the structures and the features the hydro atoms. The hydro atoms will be first next is size, third is basically the fusions the what kind of the fusion is

there. So, these are the thing then, so in these for example ((Refer Time: 05:28)) carbon this is nitrogen hydro cycle, then we sugaring size, ring size normally what is the ring size ring size I would say like this 6 5 6 it makes the sense right.

So, if you say, so that means I mean without writing you can simply say the carbazole is a nitrogen hydro cycle 6 5 6 system, more impassively you can write 6 5 6 the 5 number continuing the nitrogen. So, likewise then if you let us say write of one more structure and you have, now something like this so; that means, you can generate structure by fusion, you can generate that mean what are the features, features again size, number of hydro atoms etcetera in the nature diffusions and all kinds.

So, like this one, the next one should be categorized as I mean one can write indigo in epsilon right or else one can write naphthoyl indole right, one can write banjo carbazole that all kinds of things we will come to this next class. But, just to see that this verities of this structure we want to know, so for convergence we can simply say these are all called banjo carbon joule that is not enough low, but still as a common noun it is perfectly alright.

Then you can just increase this structural diversity just by putting one more nitrogen somewhere else. For example, the 1 nitrogen is placed some parallel to this another nitrogen this is categorized as Caroline, so it is pretty famous kind of molecules they occur in nature, as well as natural products, as well as synthetic materials likewise carbazole, carbazole could be of different kinds. Carbazole could be natural occurring could be also synthetic materials.

And as you go on you will see carbazole also form the mono bar of the back bones sorry polymers. And occasionally you know they would be considered as the up to electronic materials, and then many of the carbazole also are semi conducting material, so; that means, they are high utility.

Student: ((Refer Time: 08:12))

Which one.

STUDENT: Carbazole.

Carbazole unsaturated carbazole is unsaturated right.

Student: That is dynamic or not.

So, and then there are molecules of this kinds these are the basic back bone, what you see here they say 6 member and 5 member system and just hold ((Refer Time: 08:50)) this is short of compound is known as indolidizine and there are plenty of organic molecules of these kind. But, structurally you see it as an additional hydro cycle the 6 member as a 5 member looks like analog of indol that's why it is known as indoliclizine and but it has the special feature, what is the special feature that the point of fusion is calling in the nitrogen occurring the nitrogen.

And there are plenty of this thing, then there are other quite famous kind of automatic system like this one oxygen this is, so what should be the common name rather what is the common name pyrilium iron.

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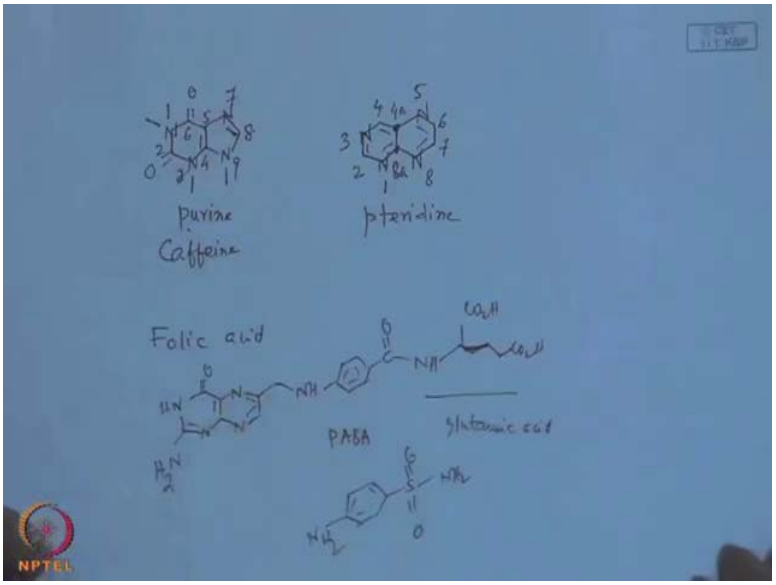

So, likewise you have all kinds of this things then many of you probably I mean we can basically based on these let us we can go on to the next one probably more popular one that could be I think many of you know here you have nitrogen by cyclic nitrogen and nitrogen, and what is the name of the basic skeleton purin. So, it is a purring, so that the basic skeleton that you have to remember shown a such a common name and the very useful name.

So, you have to remember them and then I should have say if you put carbonyl here, carbonyl up here and by convince you do not write. So, one line means you say metal group, we do not in a structural writing we do not write this things are other things only these hydrogen hetra atoms should be indicated in the fundamental lecture or the structural writing. And then you have double bound and these thing then you have the metal group of here, and the metal group of here.

And what is the nick name of this molecules say real life molecule a real life molecule not really will come to that zynthone also will come to that these are all very common name you have to remember I mean nothing can be done. But, this is caffeine I think you did this work right lab isolated caffeine, this is very common experiment right; obviously, we did this.

Student: Sir we did that.

Right it is the nice white powder.

Student: In our college

In your college, so it is a nice thing; that means these are all things we begin our life or day with hydro cycle compounds at with infinite d t. And then, so let us see other important compound could be like say this one, once again 6 member, 6 member and 6 member. Then when you write you can just quickly remember this things 1 3 relations ships if you go to the pure in nuclease, this left hand to one also 1 3 this is also 1 3. And the basic skeleton up here, let us say then you have 2 more nitrogen 2 more nitrogen.

And what is the name.

Student: Teradyne.

Teradyne, so the basic nuclease is Teradyne, now when I say Teradyne why it is, so famous, why should it be known to us. Because, this nucleolus occurs in many, many important pharmaceutical, one of them each folic acid, many of you know I guess phonic acid. So, folic acid is known from our school life right, but at these point you have to describe in terms to the structure, when I say what is the folic acid you have to say something about the structure anybody knows what is the folic acid.

Student: ((Refer Time: 13:22))

So, partly; so that means, you have to have 3 component let me write down this is very useful one. Because, I will tell you little more about this structure, structure is very easy once you have identified the nucleolus, then it has the metal group forget about double bond etcetera all this things. Then like what in the says that it has to have a ring carbonator ring kind of the things, so this is pram I mean benja acid part then here little bit of interestingly I mean if you remember ((Refer Time: 14:00)) what is ((Refer Time: 14:01)) how do you remember ((Refer Time: 14:04))

Student: Once used to see to see remember.

I would say ((Refer Time: 14:09)) is the amino acid which contains how many carbon atoms because all amino acids will have one of the back bone carbon one back bone I mean back bone, so the based is basically the side screen. So, how many sides are there in carbon are there.

Student: ((Refer Time: 14:24))

No three including these thing these three, so carbolic acid, so that is how very easy to remember this structure. So, once you practices I think I made the mistake, so now it is 3, so what you see here this is a ((Refer Time: 14:42)) and this is what we call PABA, PABA means.

Student: ((Refer Time: 14:51))

So, like wise.

Student: ((Refer Time: 14:57))

And then double bond double here, and now we just basically just fill in the blanks you have to remember that this as the amino group. So, this is folic acid, folic acid what we find folic acid it is the component it vitamin b complex, so which ever part of it and this is acutely the origin of discovery of chemotherapy many of you do not know, the first anti biotech that was discovered is chemical literature was.

Student: ((Refer Time: 15:34))

Right sulfur aluminide, so sulfur aluminide actually the person you know who discovered this they found an analogy that if a cell survive on the use of phonic acid, if you block the metabolic of this cell by putting a similar structure. And if you look at it is the benzene up here this I mean and instead of the carbolic acid it you put this one, and it is non metabolic, metabolic shocks and cells do not get the food and of course, they will dies, so this was a principle that and now many of you know most of the sulfur ducts at least some sort of typical different drugs travel in the markets and the antibiotics.

And there are other kind of structures I thing by the way just let me just quickly give you an a important information though will come back to that later, but the movement lecture why the numbering of the system here it purine and the teridine all of us know this purine are present in sorry it purine nucleus present in adenine and one ((Refer Time: 16:49)) right.

But, what is the numbering starts from, the numbering starts from peculiar numbering row I mean absolutely that is no signs behind which numbering starts from here the purine nucleolus on the left hand side the purine nucleolus left top corner or in this case 1, 2, 3 this is 4, 5 and take it to the 6. Then what is the 7 and again it is anti clock wise now clock wise 7, 8 and 9 that is no signs just you have to remember.

In case of deriding it is different deriding is 1, this is 2, this is 3, 4 and mind it this fusion points are not number 5, 6, 7, 8. Then the carbon then what are the numbers of these numbers it should not be 9 and 10, actually the top one should be taken as 4 a and this one next one will be taken as 8 a. So, these are the numbering you have to remember and...

Student: Sir this are only for the deriding.

Only, like many of you know also you have the structures, they have a particular no main culture, there is no systematic no main culture contained. Because, those domain culture that the numbering systems has been retained and the old numbering systems.

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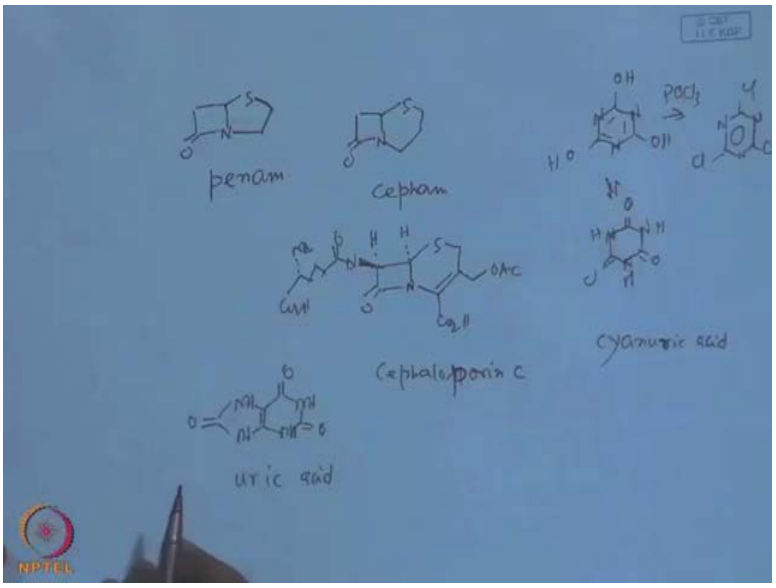

Now, let me, so you know now let me give you one more biological important molecule for example, all of you know by now I do not have to say but this a common names have to be know because for important communications you have to see here for example, what is the backbone.

Student: ((Refer Time: 18:44))

No beta elect am, only the 4 membering part and then 5 member with sulfur what is the name ((Refer Time: 18:57)) 5 fins system, but together it has the nick name.

Student: ((Refer Time: 19:04))

The jet thing you have to remember that is all, like similarly like say this one, now you have the 6 member cyclone compound. So, it has again a nick name the name is called

Student: Cephan.

Cephan, so what is cephan it is by bicycle compound with continuing and then why are they, so famous that also you have to remember. Cephans why do you say cephans is heard by everybody, but what is the basic structure now you will know, the basic structure is this is the again you can just without thinking much you can write that 4 member and a 6 member what else, what are the structural features. The structural feature shear you have which 6 hydrogen that you have to remember 6 hydrogen.

And those were studied chemistry of pinecone they would know this particular position is occupied by 1 hydro atom nitrogen. So, pinecone g, pinecone g was one of the earliest anti biotic, and pinecone g must have an amino group of here and than in these case the one I am writing here again is amide and you have this 1, 2, 3, 4 may be I do not know this is as per acid something, and then you have a carbolic acid here.

And then this is the double bond and these are the typical carbolic acid of the nitric, this is one of this actually this is cephalosporin we do not have to remember all this structures, but you have to have the idea about the basic structures. So, they are other molecule I think there are plenty of other different kinds of molecule, let us say let me see I mean we can think about for example, and this is the molecule often we talk about again what you will find this is N H, N H it is a 5 member find of thing and per ion nucleolus and then ceo and then N H and again, but all of this carbon are in the form of veto groups.

So, and it has the gain a name does not n m very famous among the non chemist what is it.

Student: ((Refer Time: 21:46))

No.

Student: Uric acid.

Right uric acid what is it famous for doubt, so any under know what uric acid is nothing but what is this one. And similarly there are other two compounds for example, this is quite alone say 6 member again, 6 member again this is 3 nitrogen this is highly symmetrical here, and which is having O H and as you can see this is in equilibrium with again a kito group and the kito groups. So, you have what you can see you have N H, N H and this is N H and then you have N H, and then you have the carbonate.

So, this is an equilibrium and but what is the name this is the very useful compound this is very useful compound. And especially in biology by pretty close actually it is known as cyan uric acid; that mean the name implies the kito form topomygist to the hydroxide form. So, I should actually try hydroxide here let me say the phenol kind of thing very

acidic, intervenes of p o c l 3 you can guess what will be the product, the product would be try chloride derivative.

So, try chloride derivative; that means, nitrogen and here nitrogen and these you have the try chloride derivative if I have the excess amount of p o c l 3. Basically acid derivative synergic chloride, so just like a you can use synergic acid chloride for converting carbolic acid into the corresponding acid chloride. So, it a chemical region and many a time this synergic acid also can be used for ((Refer Time: 23:54)) element, and then there are many uses synergic acid of chlorides.

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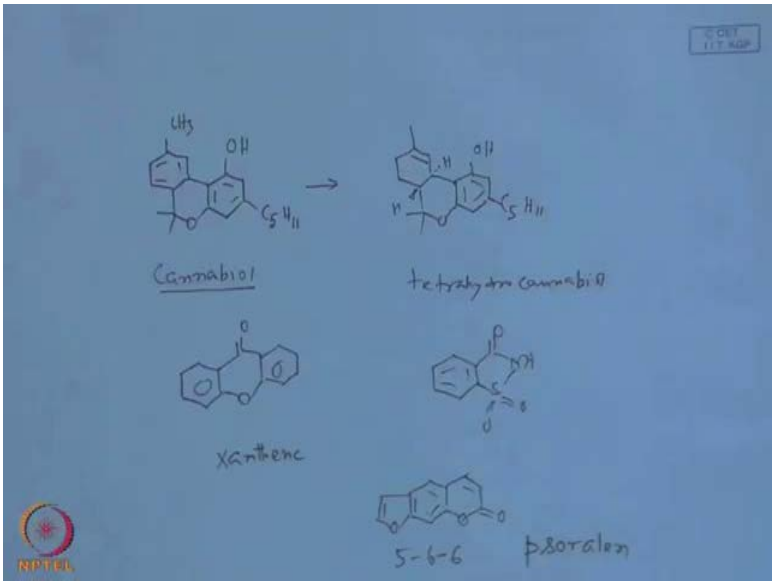

And then let us say one more important class of molecule that I think I will write this probably you would be knowing these this is a molecule. Again what you see here is the way I write it is two benzene nucleolus; that means by phenol system then you have the 6 number drain with the oxygen of here the oxygen of here. And, so the methane group you have a C H 3 group of here then you have O H and here you have C 5 H 11 aliphatic size.

Anybody is familiar with this structure, this structure is cannabiol anybody knows it is a active component of hushes, marijuana, you can show them in if you take this actually this one is inactive. So, the active form is partially hydrogenated; that means, this ring parts remains as it is then you have the phenol O H group and so you can have then and this partially hydrometer here, then you have the hydrogen of here and then alpha

hydrogen. And this is known as tetra hydrogen of course, I mean tetra hydrogen this is the more active one.

Student: ((Refer Time: 25:46))

Can application, application means we have to smoke just like a the berry if you smoke you will be in different word.

Student: Ganja.

Ganja, so no mind it, but this I can tell you it is interesting it is very interesting, but at the same time you have to appreciate the activity. That means, we every day solve or we eat or we take all different kinds of chemical, different kinds of foods, but they have typical action, but and this small amount of this will have separate hexane on the human body, physical hexane homogeneous I cannot pronounce alright halo.

Student: ((Refer Time: 26:39))

No not halogeneous halos genus something halogenation right any case right something like that you may basically we can see I mean day dream. If you want to see day dream, just take one and then ((Refer Time: 27:00)) I can tell you I mean if not recorded then I can tell that this is one site two that is by mistake though, I mean someone suggested me to take any case. But, no, but what is important that such a simple small molecule as aromatic nothing it has, so profound effect on the chemical axis.

And even today I know one of my friends still working on the connubial simply because if you can meant the bioactivity means reduce the bio activity, then that will be useful for the human kind that is all. So, people are working on it and there basically all these molecules are taken together consider CNS agents, means Central Normal System, so that is the nice to a of a way of combating different regions, if you can monitor here, you can monitor here then everything.

And, so this is very useful one then there are other molecules like since this afternoon some terms I was telling xanthene. Xanthene is nothing but you have the molecule of this kind called xanthene, this is the xanthene nucleolus then this is xanthene nucleolus. So, and...

Student: Sir, those two hydrogen's are xanthene hydrogen.

In transition right, so then other kinds of molecule many of you know, but for the simplicity say just for to reminding you that one can also see this is the very famous molecule right. So, but it should be a consider as a hydro cycle, this one is nothing but...

Student: Saccharine.

Saccharine right and there are other saccharine there are plenty of different cultural molecule, but I will write one more who is once upon the time we worked. Let us say this one, what you will see this is the molecule again the oxygen hydro cycle, so is a 5 and 6 and a 6 member dream right. So, you have two independent heterocycle pheron and electon, but there are all kinds of name though.

For example, many of you know that benzene and electron ring together known as commarine. So, commarine is very famous molecule right, especially those who are working in the physical chemistry, what is this famous for commarine most of the commarine derivative, either demine circle or meant to I know who work they work in kumara in they are foliation molecule. For us and the feuro kumaran's for in is said to be pharmaceutical and that is the molecule called 8 m o p i s 8 f x c.

But, one of these this is one of the basically a nuclear of a very famous molecule called saccharine, saccharine is the again were the medicine used for the treatment of soirees, what is soirees again it is the skin disease I mean what do u say this is where you can have lot of etching and other things.

Student: Scaling.

Scaling is not really is I have no idea, but it is very painful that much I know I remember I have seen one patient in undergoing they a treatment of soirees, she was put in a hospital and it was big room and she was totally exposed to u v light. So, u v light the medicine was give applied on her body and then u v light was shown given on them, and these are all called the dynamics drugs. So, when you are exposing this it drug to be u v it undergoes 2 plus 2 cyclo addition with the median system has the double bond, so it form the 4 membering system.

So, this is one of this then there are plenty of other many of you know I guess this structure of metalize group, what is the structure of metalize group, structural meth line must be known to all of you no idea menthe line blue.

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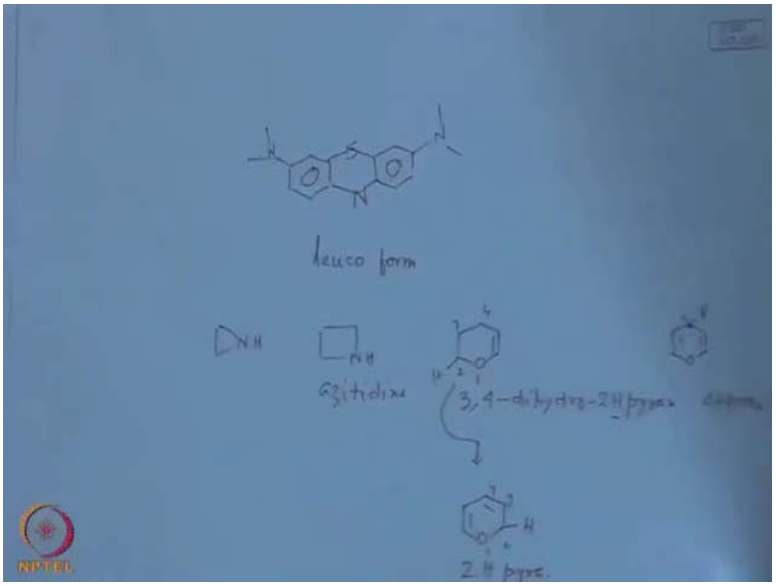

So, we should no that is the medicine it is lots of drug no, it is a try cyclic and we will have sulfur on the middle and this nitrogen ((Refer Time: 31:55)) And then of course, rest of the things are quite simple that you have rings, and what else any idea a leuco form, leuco for means there is the drug chemistry called leuco form, you call often leuco form, what is it mean reduced form this oxidize of course, it is oxidize.

And nitrogen you will have N and I metalize group and so likewise there are other things like bio times also is a such bio time and there are small molecule that are you have to know and this is the system called...

Student: Azitidine.

Azitidine, if I put the double bound this known as azitidine right similarly you have molecules of this kind that this is known as azitidine. So, like wise and then there are other things likes for example, many of you are familiar with this molecule for example, what is this molecule.

Student: Tetra hydrant.

Tetra hydrant more precise it is known as 3 4 dihedro no actually there is the form called 2 pyran 2 H pyran. For example, actually the pyran nucleolus is something like this. This is called pyran nucleolus, and then we will come back to this sort of things like we write hydrogen, actually this is called indicated hydrogen, you have to indicate the number of the hydrogen or the place of the hydrogen by saying hydrogen if hydrogen is present in axis, in axis over the what over the S P 2 carbon atoms.

Suppose, if you had a the S P 2 carbon atom you would have expected a only the single hydrogen, now we have the additional hydrogen. So, this is actually a 4 H pyran, so; that means, this comes from actually here this is let us say this and this is the what should be the name of this one, this is actually 2 H pyran. So, that means, in this case 2 H pyran and; that means, this is 1, this is 2, this 3, this is 4. So, the 2 this portion is known as 2 H pyran and then you have 3, 4 die hydro or you can say 1, 2, 3, 4 why because the hydrogen is constitute to substituent here, so it is given the name 2 H.

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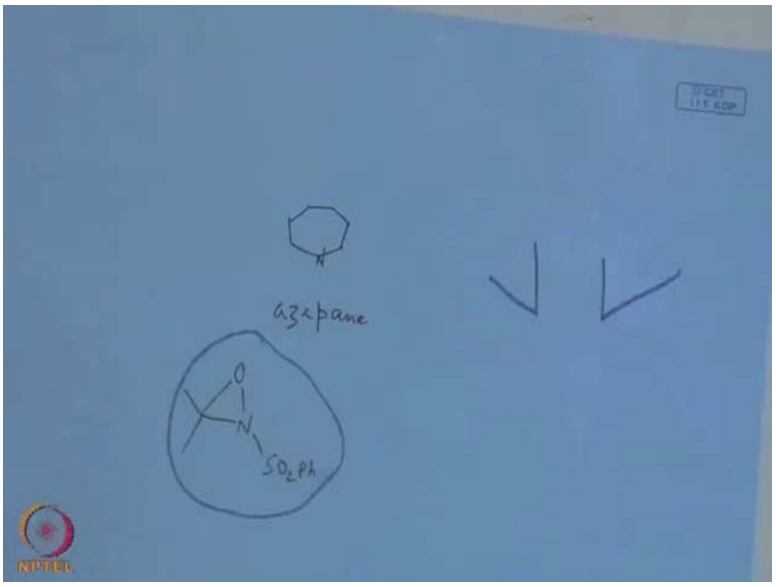

And then other I will like just last minute may be just one more structure that should be known, once again we have somehow come across this molecule here 7 member, there are very 8 member, 9 member I mean I am truly speaking then this is a if you have nitrogen. So, this is basically we known as pane, pane acutely stand for this 7 member then now if you put a azepane you say basically nitrogen ((Refer Time: 35:55))

So, similar if you have the solve for ((Refer Time: 35:58)) and if you have double bonds here as a pane. So, all this names are we will talked about more on the next class and then let us say I think I have the talked about the most of important one, there are other hydro cyclic reagents also. And there are plenty of hetero cyclic molecules, which are useful as natural products, which are useful as medicine, which are useful as a agricultural chemicals, polymeric monomer then the chemicals slide which are used oxygen or reduce agents.

So, one of them I think many of you probably remember we talked about the agent called dubiety agent, what is the dubiety agent, dubiety agent is basically oxygen agent. So, it must have an oxygen and it is an hydra cycle in a hetro cycle and with the smallest hector cycle and contrast 2 hetro atom oxygen and nitrogen it is a predictable one. But, it can used for oxygen ((Refer Time: 37:18)) I think I stopped here right. So, we have actually we have take care of most of the important nucleolus.

So, 5 member, 6 member occasionally 7 member and their most of them are many times that is all, and there are other times of molecules also known as cyclones, inorganic chemistry we are not getting know what is the cyclone, cyclone means it is the macro cycle 4, 8, 9, 10, 11, 12, 12 member of macro cycle continue 4 nitrogen atoms symmetrical molecule. So, you can understand what it is these are nice ((Refer Time: 38:27)) metal complex formation of the metal complex, then there is a I mean whatever we have called ((Refer Time: 38:35)) what is that...

Student: Antic acid agent.

Antic acid agent, but that is not enough that has to be known to you because this is advance level course, but what is the next thing the structure. So, we will ask the question next time, and read little bit of this and then let us say for example, one more molecule I have in my naught is called for ribo flaming, what is ribo flaming when I say ribo flaming then you have to describe to be what is it...

Student: ((Refer Time: 39:11))

That is not enough that is what I am trying to say, you have to tell us something about the structure, what is the possible structure if I; that means, you can give get better idea,

if you tell us what is the structure, it is basically tertian nucleolus banjo deriding. So, I think now you can make out what is it right.

Student: ((Refer Time: 39:32))

No I said banjo deriding, so let me say benzene and few ((Refer Time: 39:38)) 1, 4, 4 and 1, 3 nitrogen nucleolus. So, any case next time we will have again the little bit of thing which should be remembered, there should be no signs in it human flexure how to name in hector cyclic compound. For example, the one I am talking about here, so what should be the name like say this one. So, in the next class we will talk about the...

Student: Ox lent.

Ox lent, so in next class we will be talking about, so what should be the name, there are two things we can say right it is oxidant as a ox lent we can say or you can say oxeye grime, which one we should say. Absolutely that are no sigh suggested whatever I said have to remember means whatever I said I have to remember and I will tell you also remember that best way to next class, we just try to remember this one, when you write this one it is the tick mark right, say anti tick mark you remember.

And then I will tell you what it is, this is the important clue in leaving in hydro cyclic compound. Especially when you have two different hetero atoms, in this case you have the oxygen and nitrogen, so fine, so what is that today's conclusion entity for tomorrow, so I think will conclude here.