Welcome to this online lecture series

presented to you by Director of

Higher Education, Government of Goa.

I'm Dr. Mira Parmekar,

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St. Xavier’s College and I'll be

continuing with the last times module,

The Part 2 of that.

This is for the First year BSc

Chemistry students of the paper CHC.

101.

Section B is organic chemistry and from

the unit 2 the reason stereochemistry.

This is the second part of the

module concept of isomerism.

Briefly, the outline, from where

where we had stopped in the previous

module. We will be briefly going back on

revising in the introduction what

was, what has been already covered.

Then we will discuss the remaining

two that is metamers and tautomers

the structural isomers then briefly

see what is stereoisomerism and then

Summarize. At the end Students do check,

You should be able to understand

the concept of metamerism and

tautomerism and write examples for the same.

Also you should be able to comprehend

stereoisomerism and see how it can be

classified and the various classes in it.

OK,

looking back from what we have

what we had already learned.

Stereochemistry is the branch of

organic chemistry which deals with

study of structures of organic molecules

in the three dimensional space.

So just for the revision sake,

this is the tetrahedral molecule of carbon.

OK,

wherein we are talking about any time

wherein visualize the molecule two

bonds are always in the plane.

One is going away from you and

one is coming towards you,

the one which is coming towards you.

This is the beta (β) bond.

This is going away from you is

the alpha (α) bond. We also

defined what are isomers.

Isomers are molecules which have same

molecular formula but they differ in

Physical and chemical properties,

and thus the two words that is ‘Iso’ and ‘mer’,

that referring to ‘same’ and ‘parts’

that is there partly same. Then

this classification also we had

seen wherin isomers or isomersm

can be classified broadly into

constitutional or structural isomerism

and stereo or spatial isomerism.

So in this we have seen in detail

this three classes that is Chain,

Position and Functional isomerism.

and in this particular module will

be focusing more on the remaining two.

That is metamerism and tautomerism,

and will also briefly over

overview what is stereo isomerism.

So, Coming to the 4th class of

Structural isomers that is Metamers.

These are molecules which have

same molecular formula but

they differ in their distribution

of alkyl groups around a central

metal atom and this sorry, central.

atom not metal.

Ok a distribution of alkyl

groups around the central atom,

and this phenomenon is called as metamerism.

OK, again we shall take example

to understand this.

In the first example we have

1-methoxypropane,

an ethaoxyethane. Both,

the molecules have the same

molecular formula.

$C_4H_{10}O$.

like last we can again cross check this

number of carbon 1,2,3,4 so four

carbons hydrogen 3 plus 2=5 plus.

Two = 7 + 3 = 10 and one oxygen OK.

Coming on the right hand side.

ethaoxyethane hs 1,2,3,4 carbons.

So again four carbon, hydrogen 3

+ 2 = five and again another five,

so 10 hydrogens and one oxygen.

So we confirm both have the

same molecular formula.

If you see here the hetero atom or

central atom we can consider as oxygen.

The two groups that are attached

to oxygen one alkyl group.

Is methyl the other is n-propyl.

So basically this is an methyl

n-propyl ether and on the right

hand side what we have both sides.

It is attached to an CH_2CH_3

that is ethyl group.

So this becomes ethyl

ethyl ether or diethyl ether.

So depending upon the distribution

of the alkyl chain on both side

of the oxygen the molecule is

differing in its structure.

So this becomes an example

of metamers or metamerism.

Same way in the second example we have

pentane-3-one and pentane-2-one.

So, Both the molecules again are having

a central atom oxygen which is

doubly attached to the carbon in

one it is attached to a carbon #2,

in one it is attached to carbon

#3 both have the same molecular

formula that is $C_5H_{10}O$.

You can cross check by calculating

the way we did for the first example,

both should come to $C_5H_{10}O$.

OK here also.

The carbonyl basically is in

position 2 or position 3,

That is how the structure is different.

Metamers basically can be also

considered as a special case of

positional isomerism that we

saw in the previous module.

OK,

coming to the last class of structural

isomerism that will be discussing.

We have tautomers now what are tautomers?

These are molecules which have

same molecular formula but they

differ in the structure OK with

respect to the arrangement of

atoms OK but they do exist in an

equilibrium with each other.

OK again will take example

to understand this.

The classical example is of the keto-enol

tautomerism. Again here we

have two molecules propane-1

en-2-ol and propane-2-one both

have the molecular formula C_3H_6O

OK again we can confirm this

has 1,2,3 carbon so, 3 carbons

Hydrogen is 3 plus 2= 5 plus 1= 6 OK.

There is one oxygen.

There is no nitrogen.

Nitrogen is for the second example.

You can calculate afterwards.

OK coming on the right

hand side propane-2-on.

OK,

this we're already seen we have

three of carbon, 3 plus 3 = 6 of

hydrogen and one of oxygen.

OK, there is no nitrogen,

so the molecule are formula

becomes C_3H_6O.

so, we confirm both the molecules

have same molecule are formula.

how they're differing is here,

Both the molecules have one set of

unsaturation that is double bond here.

The double bond is between your

carbon number one and two.

OK, here the double bond is between.

OK, I can name the same way

the number the same OK 123-123.

So this carbon will be having the

the double bond between carbon and

oxygen as opposed to in the first

molecule so this becomes the enol form.

This becomes the keto form and

this is classically known as

the keto-enol tautomerism,

wherein both the molecules simultaneously

exists and they can interchange OK.

They're basically in equilibrium.

Same way in the second example also OK,

what we see here is we see an

enamine-imine tautomerism.

So in imine you have the double

bond between the carbon and nitrogen, in

enamine you have it between

the two carbons.

OK again,

if you see you can calculate the

same way how we calculated for the

first example the molecular formula

for both should be C_3H_7N and

only they differ in the structure,

that is the distribution of electrons.

So how basically you interchange

is when you put one of these hydrogen

over here and it will become -CH3,

this become -NH and the double bond

is shifting from here to here.

That is, this is shift.

This is shifting here and the

hydrogen is shifting from here to

here OK, that is the change.

OK so if you have understood this

concept of Tautomerism we have covered all

the five classes of structural isomerism.

Then we go to stereoisomerism.

Now, stereoisomerism,

You'll be learning in detail.

OK in the follow up modules I will just

briefly introduce what are stereoisomers.

Stereoisomers are molecules which

have same molecular formula

and they also have same structural

formula but the place they differ,

is how this atoms are arranged in

the three dimensional space and

depending upon this arrangement they

will have certain classes so they

have certain they have two subclasses OK,

which can be also further divided.

In one slide,

I'll show you all. Stereoisomerism,

basically we talk about the

spatial arrangement or spatial

distribution of atoms in

The given molecule.

OK,

so basically we're talking about visualizing

the molecule in the third dimension.

Stereoisomerism can be broadly

classified in two classes,

conformational isomerism,

and configurational isomerism.

The basic difference between these

two is conformational isomers

can be easily interchanged,

or they can easily get interconverted

to one another,

OK, by a simple rotation of a single bond.

Ok, rotation of just one single

bond will give you the two isomers,

and in conformational isomers

you'll be learning in detail the

conformation of ethane, butane,

and cyclohexane OK. But as opposed to this,

the configurational

isomers or isomerism is wherein

there is no no interconversion OK.

OK by rotation.

OK you will have to break.

You have to break the bond to

convert 1 molecule to the other.

This configuration isomerism also can

be further classified as optical and

geometric that also you'll be learning

in details in the follow up modules.

To summarize in this module what we

saw was metamerism wherein molecules

have same molecular formula but

differ in the distribution of alkyl

group around the central atom.

Tautomers wherein molecule have same

molecular formula but differ

structurally in arrangement of the atoms.

and existing equilibrium and we also saw

briefly introduced what is stereoisomerism

that is molecule with same molecular

formula, same structural formula

but differ only in the arrangement

of atoms in the third dimension

and the three dimensional space.

OK, the classical book for reference is

Stereochemistry of organic compounds

Nasipuri. This should solve all your problems.

If not,

you can refer to the second book as well.

Thank you very much for viewing.