

good morning

so far we have seen how to

draw Lewis dot structures it's clear that um as i mentioned before from the Lewis

structure you cannot tell or predict the shape of the molecule how to then how to tell the

shape of the molecule

so if you see some object you can tell the shape of the molecule okay it is a sphere or rectangular or square like that if you see the object you can tell that but molecules

are cannot be seen by our naked eye then how to see the um shape of the how to tell the what is

the shape it has then that can be done still one can find out the shape of the molecule by ah doing

excellent spectroscopic method another method is the single crystal x-ray diffraction method that

those things we are not going to see here but however one can tell the shape of the molecule

using a model called VSEPR the VSEPR model this is called a valence shell electron pair repulsion model

so using this model one can predict the shape of the molecule

so what is the then what is the principle behind this model you can see that from

the um okay title valence electron pair repulsion

so if you take two electrons they repel each other

because the charge on the two electrons is the same

so when they approach each other they repel

each other they cannot get closer because they have the same charge

so electron pair means a

pair of electrons is involved in forming a bond

so as a result when the okay there is a

repulsion between a pair of electrons so that is why valence shell electron pair repulsion

and then which electron pair repulsion with electron pairs present in valence shell of an

atom

so that's why okay we are going to tell the shape of the or predict the shape of the molecule

based on them electron pair repulsions experienced by the electron pairs present in the

valence shell

so that

so that is why this model is called valence shell electron pair repulsion model

so so if you take okay um a region of electron density region of electron density i mean here

yep okay bonding electron pairs okay

so region of electron density means okay

so that is which are equal to bonding electron pairs and then you have lone pair okay lone pairs you have lone pairs or unshared

electrons you have

so if you take a molecule it has um okay surrounding up

so your center you have

a central atom surrounded by a um terminal atoms which are connected to the central atom by bonding

so each bond is consisting of two electrons in addition the central atom can have a lone pass

so there is a repulsion among them so there can be a um repulsion between the bonding

electron pairs for example you take a molecule a and it is surrounded by a molecule b okay atom

terminal atom b another atom b

so a is a central atom b is the terminal atoms which are connected to the central atom a by bond

so this is a bond

so that a bond means two electrons are there

okay

so here there are two electrons are there now um ok the whole molecule that is ok

a b 2 molecule is stable compared to its atoms

so the atom a like 2 likes to have

both atoms b bonded to the atom a okay so but the problem is um there is a repulsion between

between atoms b

so they don't like each other like that they don't like each other but the central

atom like to have them together

so the best way um that the central atom can have these two

b atoms which are rippling each other is is is to have them as far away as possible

okay okay the central atom a like to have b atoms as far away as possible okay they have to be as far away as possible why otherwise there is a repulsion

between them

so if

b atom reduces electron density electron repulsion between atoms b by keeping the b atoms away from

each other okay such in such a way that there is a less repulsion a minimum repulsion between

them

so the best way to arrange okay two atom that is b around a is in a linear fashion

so if

you take a ok circle in the middle you have atom a ok in the circle is a 360 degree okay

so if

you divide the 360 degree 180 degree will come

so you can put atom b here

so the angle is 180

degree okay

so 180 degree that is the best way of arranging atom b around the central atom

a okay any arrangement less than this okay any arrangement having angle less than 180

degree will will produce more repulsion as a result the structure is not stable more repulsion

means energy is positive okay repulsion between electrons will lead to a positive energy so energy should be negative that is more stable so in this case if you arrange these two atoms for example a um here like that okay here so the angle between 2 b atom is 90 degree okay it's 90 degree now because it's 90 degree they are closer b atom both two b atoms are closer to each other so the repulsion is more so energy is positive energy is more which is not favored but if you put the b atom in this way okay the angle is 180 degree the two b atoms are away from each other as a result okay the repulsion is avoided energy is minimum so that way okay you can tell using based on this concept you can predict the shape of the molecule ok that is why ok the shape of this type of molecule is linear ok for example carbon dioxide you take ok carbon dioxide ok first you have to do a leaves dot structure for carbon dioxide carbon dioxide so valence electron four plus two into six electrons okay because six is the valence electron of oxygen so you have 12 plus 4 16 valence electrons are there okay so 12 plus 4 16 so you arrange them so c okay approximate shape you can arrange them so arrange the two oxygen atom around the carbon atom so you can then you have to uh spend four electrons to form two bonds so four electrons are gone minus four so remaining is the twelve electron around them such that octet is reached for every atom so 12 electrons are there but if you look at the central carbon atom it is not um at achieved um eight electrons so you have to convert this lone pair into a bonding pair this also you convert and then you will you can have um c um double bond o like that okay now octet structure so the octet of electron is achieved by the central atom because two electron two electron two electron two electrons there are eight electrons here also eight electrons here also eight electrons so the octet structure is over the same structure you can also write you can also write the for carbon dioxide you can also write in this way both structures both are correct okay both so i mean this sector you can write this way also and you can also write this way also okay both structures are correct as far as leave is that structure is concerned but what

is the shape
as you can see here as you can see here in this structure two atoms are occupying positions which are having 180 degree they are far away from each other but in this case okay the angle between two oxygen atom is 90 degree
so because this is one region of electron density this is one region of electron density okay electrons are ripple each other they don't like to be closer
to um each other they like to be as far away from each other as possible
so as a result the correct structure for carbon dioxide is a linear structure although it has a double bond between the um carbon and oxygen it should be taken as one electron region
so it has ok two bonding pairs but connected to the one oxygen atom
so this is a one electron region ok
so this is one electron region
although it is connected to a um carbon atom by double bond but it should be taken as one electron region only ok
so as a result ah the shape of the molecule is linear for carbon dioxide structure of this linear which is what observed x mentally
so the model predicted that is a vsa epr theory model predicted the shape of the carbon dioxide correctly okay which is consistent with the shape determined by x mentally now so if you take a okay now let us go to another case
you take a molecule of this type a central atom b f 3 boron trifluoride yes central atoms
the boron the terminal atoms are fluoride boron is surrounded by three fluorine atoms okay
now first job is to draw the leaves dot structure boron valence electron is three okay
so fluorine okay three into seven electrons are there for fluorine each fluorine atom seven
so it is a twenty one plus um case twenty four electrons twenty four valence electrons are there
so if you arrange that b okay
so there are b is the um central atom because it has the um highest bonding capacity okay because it has three unpaired electrons
so you can arrange okay
three fluorine atom around the boron fluorine atoms around the boron atom okay
there are okay
three bonds
so each bond is two electrons
so six electrons are ground are gone
so here is the remaining is the 18 electrons eight electrons should be distributed in such a way that each atom has eight electrons you can distribute this way ok

so eight electrons are consumed but here you can see here the central atom doesn't achieve the octet rule so then actually what you can do is you can pull this lone pair to here and then you can have that eight electron around that so as of now the number of electron around the boron atom is less than eight electrons so this is called electron deficient or lewis acid ok this is electron deficient okay or lewis acid so BF_3 is a lewis acid molecule lewis acid now those concept will be you will be studying later on now the point here that here we are concerned about the shape of the molecule now ok now this molecule um contains ah how many pairs of electrons how many regions of electrons this is one region of electron so this is a lewis dot side channel so one has to write the lewis dot structure first okay next step is to find the shape of the molecule based on the um electron pairs that electron pass can be bonding electron pairs or lone pair of electrons so using ok those pairs of electrons you have to draw the shape approximate shape then we have to think about the repulsion between the bonding okay repulsion between the lone pair lone pair inter repulsion lone pair bonding pair repulsion and then bonding pair finding bonding pair repulsions ok so this here in this central atom in this central atom there are three bonding pairs are there so when there is a three bonding three atoms are kind of three regions this one region this another region there are three another regions so if you take a circle okay this is a boron atom okay so the circle is a 360 degree should be divided by 3 then you will have 120 degree so that that's a okay so the angle between here is 120 okay so 120 so that is the best way so you have what is the 120 because at 120 degree um you can have these three fluorine atoms far away from each other so if suppose if you draw any other structure b for example like this ok so like this ok you can draw as far as you can put the electron here ok so here still the lewis structure is correct but the angle between them is 90 degree so it is not a um okay 90 degrees so this electron density is rippled by

this electron density

so they ripple each other repulsion is more because the angle between them is lower but if you look at arrange the three atom in this fashion okay 120 degree away from each

other okay then the repulsion is reduced that is a purpose you should have an arrangement

where there is a minimum repulsion between the electron regions okay electron regions means of

bonding electron pairs are lone pair of electrons

so that angle is increased compared to this

one

so when the angle is higher less repulsion okay

so this is the best arrangement for BF_3

then the shape what is the shape when you have a central atom connected to a three atoms

then the shape of this molecule is um okay trigonal planar structure it is called a

trigonal planar this is called a trigonal planar ok

so it is all in a plane three plurine atoms

of atoms are in a plane

so trigonal ok trigonal planar structure is the correct shape of this molecule now let us see another molecule for example CH_4

so as you know that is methane you

can draw a lewis dot structure and then you will see that arrangement of four hydrogen atom around

the central carbon atom in this way ok then you can see that

so how many pairs of electrons are

there it contains contains okay four electron pairs

so you have a central atom surrounded by four

electron pairs okay now okay

so as i mentioned before if you take a circle okay in middle you

have a carbon atom and arrange them okay divide this 360 by 4 then you will have 90 okay 90.

now

if you put hydrogen here and here okay it's a kind of square planar geometry but the angle between

them is 90 degree but this is not the correct structure square planar is not the shape of the

methane okay this is square planar will come if you arrange the four hydrogen in a plane like

that but if you arrange the four hydrogen atom in this fashion that is the central carbon atom ok

so you put two hydrogen atom on a plane and one of the hydrogen atom ok towards you this is two

osus and one of the hydrogen atom away from you ok then you will have the angle between them is

109.

5 degree

so compared to this structure is a square planar geometry square planar shape

ok shape and geometries are interchangeably used here and then here 90 degree between the two

electrons this is one electron density these are another electron density the angle between them

90 degree here as for the same atom for the same electron regions okay the angle is increasing how much is 109.

5 degree

so the angle is higher higher the angle the less the repulsion between the atoms

so this structure is favorable structure for methane and the shape of this name of

the shape of this molecule is a tetrahedron ok name of the shape of this molecule is

tetrahedral i can explain that using a model ah system ok

so this is a shape of the tetrahedron

as you can see here as you can see here these are shape

so if you look in this way ok if

you look in this way this this is hydrogen the consider this is a carbon atom middle carbon atom

and these and this and these are hydrogen atoms which are bonded

so this is a bond

this is are the four bonds are the four now um ok

so you can see here in this way this

hydrogen is away from you

so which is given in this way okay this hydrogen is

towards you which is given in this way okay solid line and these two ok and this and

this atoms are in a plane ok

so the then if you look at the angle between them from here

to here and you can see that which is 109.

5 degree

so so ok

so that is why

so basically ok so

you have a range room ah molecule in a tetragonal fashion um ok

so in a tetragonal fashion

so the

angle between the two hydrogen atom is 109.

5 okay

so that is the best arrangement of

arranging four regions of electrons around the central carbon atom compared to this one

this one the angle is 90 degree more repulsion here angle is 109.

5

so repulsion is less and the

structure shape of the molecule is tetrahedral now let us see ok ah molecule of this type ammonia as you know first you have to write the

leaves dot structure it is a five plus three okay ah phi is a valence electron of phi is three

plus eight electrons

so you can draw the shape of the um you can draw approx approximate shape of the ammonia molecule three hydrogen atom around the central hydrogen atom

okay six are six

electrons are there for forming a bond one more electron two more electrons is there

so that two

more electrons would be added to the central atom central hydrogen atom now

octet structure
is attained by the central nitrogen atom okay for hydrogen it is only two
electrons so
it is this is the correct leaving structure now how many pairs of electrons
are
there it has three bonding pairs and one lone pair
so in total four electron pairs are four regions of electron density ok
so how to arrange the four ok four
regions of electron density as i just we have seen for this type of four pairs
of electrons best
arrangement is a tetrahedral ok that we just now we saw that then if you put
the tetrahedral ok
the shape of the molecule ok
so it has a pair you can draw like that also ok a pair here
your lone pair is shown in this way this is orbital containing a lone parabola
transfer
now ok
so what is the shape then what is the shape of this molecule now once again
which can
be explained in this way
so this is a nitrogen ok these three are hydrogen and this is a lone
pair consider this as a lone pair and this and this and this are hydrogen
atoms ah let us
continue and then
so you have a ammonia molecule ok
so um here is the ammonia molecule this
is a nitrogen atom and this these three are the hydrogen atom and this is a
lone pair consider
this a lone pair
so if you draw a okay a line from here to here and here here and here here
there
is a one face similarly here and here and here okay here and here and here one
face similarly
here and here here one face
so it forms here okay plane atom trigonal um a planar okay trigonal
shape a triangular shape forming a triangular now the shape of the molecule is
ok ah now
this is a okay lone pair of electrons to tell the shape of the molecule we
should
not include the position occupied by the lone pair of electrons
so this should be removed to
tell the shape of the molecule ok we have to we should not consider the
position of occupied by
the ah lone pair of electrons now you can see that this is ammonia molecule ok
so this ammonia
molecule ah shape of this ammonium the shape of this type of arrangement is
called a
trigonal pyramidal shape
so it has a trigonal pyramidal
so the shape of the ammonia molecule is
a ok um trigonal pyramidal because ok the shape is like this okay
so you should not tell the
shape of the ammonia molecule a strata heater tetrahedral geometry will come
if there is

a atom in this place okay like methane you have four hydrogen atoms
so its shape is ok its tetrahedral but to tell the shape of the molecule one should not include the region occupied by the lone pair okay
so you have to tell the shape of the molecule based on only the atom positions so
for ammonia the shape of the molecule is trigonal pyramidal okay
so it's a trigonal pyramidal so this is a one face here here is another face here here is another face
so that is a trigonal pyramidal shape now ok
so now this is um then what is the angle between the two hydrogen atoms the angle was found to be 107 degree
so okay as far as okay four regions are concerned the best way to arrange the four regions of electron density is by tetrahedra but
it is found that the angle is one zero seven it is less than ok one zero seven is less than one zero nine point five degree which is for tetrahedral okay tetrahedral which is for tetrahedral so
the angle is one zero seven what is the reason
so there is a reason how to explain that lower angle observed here now you have to consider what is the difference between them between a bonding electron pair and lone pair of electrons
so if you take a central carbon atom for example CH_4 ok
so you have a bonding pairs there are four bonding four bonding pairs here
so they are all equivalent if you take ammonia okay you have a three bonding pairs and then there is a one lone pair this is a lone pair
so this these are the four here three bonding pairs one lone pair now you can see that um the volume what is the difference between ah
between the volumes occupied by the lone pair of electron and the bonding electron pairs the volume occupied by the lone pair of electron is larger compared to the volume occupied by the bonding electron pairs why is that that can be explained qualitatively um if you consider carbon and hydrogen okay there is a bonding electron bonding electrons which is ok
so this bonding electron is connected to two nucleus two nuclei there is a one nucleus here is another nucleus
so this is the bonding electron is stretched between two nucleus okay two nuclei as a result
it became thin okay this is it's a thin
so it's like that it is like that okay but if you take a lone pair it has um a link to the this atom this is atom central atom this is central atom here is
a central atom okay the lone pair is connected to its own nucleus only but there is no atom in
the opposite direction here there is no atom

so as a result this lone pair of electron is not pulled away or not shared okay that's why it's unshared lone pair

okay it's not attracted by the nucleus which is which could be present opposite to this nucleus

so it is not there is no two nucleus present for the lone pair of electrons so as a result lone pair of electron has a free volume

so it is free to move everywhere it's spread by itself okay it also itself

so in such a way that it occupies more space compared to your bonding electron pairs okay if there is a nucleus here then this lone

pair also will get stretched like bonding electron pass since there is no atom nucleus present

here nucleus attract the electrons

so there is no nucleus here

so this bonding lone pair

of electron occupies more space compared to the bonding electron pairs ok as a result okay

there is a because it occupies more space okay there is a repulsion okay it pushes the

bonding electrons these are the bonding electrons pushes the bonding electrons down ok

so as

a result the angle is less that is the reason ammonia has okay ammonia angle is okay the angle is

107 okay if you take a carbon the tetrahedral ok the angle is 109.5 point five ok nine point five

so here all are bonding electron pairs here you have okay um three bonding electron one lone pair

so since the lone pair occupies more space okay okay as a result more repulsion okay

so the

repulsion can be arranged in this way lone pair lone pair repulsion is greater compared to lone pair lone pair okay bonding pair and then which is greater compared to bonding pair pair

so the repulsion is highest for lone pair

lone pair if there is a two lone pairs attached to central atom the repulsion between them is

greatest

so lone pair lone pair okay repulsions greatest one compared to the lone pair bonding

electron okay bonding pass which is less compared to this one okay this is still higher compared to

the bonding electron bonding bonding electron pass bonding electron pair repulsion

so so then okay

so the repulsion decreases from left to right side decreases this is this has lone pair

lone pair repulsion is the greatest repulsion so in that way you have a repulsion between the lone

pair of electron and the bonding electron pairs there is a repulsion okay
so that is greatest okay
compared to a bonding electron pairs
so this is a bonding electron pair this is a bonding electron
there is a repulsion however the repulsion between lone pair and the bonding
electron is the greatest
as a result it pushes these bonding electrons these bonding electrons down as
a result the angle
between the two hydrogen atom is one zero seven it is not one zero nine point
five which is a typical
for tetrahedral arrangement of four atoms around the central atom here
although you have ammonia
you have four electron pairs the angle is one zero seven because the lone pair
present on the
nitrogen atom pushes the bonding electron pairs down okay q says the bonding
amount four hydrogen
of three hydrogen atom closer to each other in here as a result one zero seven
is the angle
between the two hydrogen atom and the shape is a trigonal pyramidal i hope this
is clear
so there
is a difference okay between the volume occupied by the bonding electron pairs
and lone pairs
as a result using which one can predict the shape and one can explain the
difference in
angle between the typical typically expected value and the observed value now let
us see a molecule
of water okay
so you know that central atom is oxidized atom and there is a okay two
hydrogen
atom attached to this one and there is a lone pair there are two lone
pairs on the oxygen atom okay
so the lone pair lone pair repulsion is the
greatest as i mentioned here
so because of that there are two lone pairs lying on the oxygen
atom
so so in total how many number of electron pairs there are four number of
electron
pairs okay one pair two pairs third pair fourth pair there are four parts the
best way to
arrange four pairs of electron is a tetrahedral
so including the what then what is the shape
of the oxygen molecule the shape of the oxygen molecule is not a tetrahedral
it is a bent
structure angular structure ok bent or angular shape of the molecule is an
angular shape ok
so is angular
so then it is
found that the angle between the two hydrogen atom is one zero four
point five angle is ok its one zero between two and one zero four point five
degree the angle is less
so this is still ok lower compared to the tetrahedral angle or the
angle found in ammonia it's one zero seven only okay it's one zero seven
because it has one lone

pair but in water there are two lone pairs so the lone pair lone pair repulsion is the greatest
okay as a result it pushes both lone pairs pushes the bonded um bonding electron pairs com to come closer

so as a result the angle is 104.

5 degree okay

so this okay one has to understand understood properly why the angle is 104.

5 okay compared to ammonia

so there is a relationship between these

two molecules ammonia and water the number of lone pairs or number of regions of electron is the

same here four here is four okay when you have a four pairs of electron the usual arrangement is

the tetrahedral

so arrange the molecule and then look into the repulsion between the lone pair

lone pairs and lone pair bonding electron pairs

so here there is a lone pair lone pair

interactions repulsion as well as lone pair bonding electron pair repulsion

so as a result

the angle is lower in water compared to ammonia

so from these considerations

we can tell ok we can predict from these repulsions we can predict so

if you can i can tabulate them number of number of electron regions if you consider and the arrangement ok if you have number of electron

regions is two the shape is linear okay shape is linear if you have three regions

of electrons the shape is trigonal planar if you have um if you have regions of four

electron four regions of electron density then shape is a tetrahedral if you have ok phi ok the shape is trigonal by pyramidal ok what is that we will see that

little later on then if you have ah six regions of electron density ok the shape is octahedral ok

so one has to keep in mind these type of if

you have two regions of electron density density around a central atom the shape is the shape of

the molecule is or geometry of the molecule is linear if you have three regions of electron

density then the shape is a trigonal planar if you have a four region of electron

density it is a tetrahedral if you have five trigonal bipyramidal there is another shape possible ok square pyramidal square pyramidal

so that is like this that we will

see later on

so there is a two ways of arranging um five electron on five electron regions

around the central atom that one is a trigonal bipyramidal another one is square pyramidal

okay

so suppose you have okay let us see five regions of electron density okay

so this is called trigonal bipyramidal okay

so this is called a trigonal bipyramidal shape that can be drawn in this way you have a central atom
for example let me take a molecule of PF_5 central atom is the phosphorus and then
phosphorus atom can be drawn in this way okay this way
so the central phosphorus atom contains five valence electrons that means five pairs of electrons or five regions of electron density okay which can be arranged in this way the shape of then the shape of the molecule this molecule is a trigonal bipyramidal this is a trigonal bipyramidal shape okay
so in the trigonal bipyramidal shape these three atoms one two three are in a plane because they are in a plane and these two
so then these three are called equatorial plane
so these three atoms are called equatorial plane
so you can see that you can draw like that okay equatorial plane and then these two atoms are okay axial atoms because these are occupying the axial positions
okay
so there are two types of arrangement one is in a planar three atoms are in a planar arrangement another two atoms are in the axial positions okay
so this way the angle between the two hydrogen two atoms suppose if you take here and here the angle between them is 120°
so this is a 120° if you take angle between this atom and this atom it is okay
so it is 90° 90° there are two types of angle
so this is the best way of way of arranging five regions of electron density around the central atom
okay any other arrangement okay um if you do okay that will have um more repulsions as a result energy will be more okay
so in addition there is another another way of arranging five regions of electron density in this way in this way you can also arrange that square pyramidal shape square pyramidal shape
so in like that
so these four fluorine atoms are in a plane and then at the top that is axial position you have only one fluorine atom
so this way also you can draw this will also you can arrange but compare to
so then then the question is which is the correct structure arrangement
so the okay energetically if you look at the energy value of these two arrangement this is slightly lower compared to this one
so most of them no compounds most of the PF_5 coordinated compounds except

coordination compounds okay have this type of geometry only trigonal bipyramidal geometry is a favorable geometry compared to the this type this geometry square energy energy of this arrangement is slightly higher ok compared to this one so there are however there are several molecules are known having this type of geometry but most of them having this only so that is a way of arranging five atoms around a central atom if you have five regions of electron density similarly what about 6 if you have 6 regions of electron density then the best way to arrange them is by octahedral manner what is octagonal shape this is octagonal shape this is the octagonal shape you can see here there are this is central atom connected to a six atoms so you can see that one two three four five six there are six atoms connected to the central atom so this is this is a ah shape of octahedral okay that is the best way of arranging six regions of our um electron density around a central atom of this okay other any other arrangement okay will lead to a um higher energy state which is not favorable so more repulsion will be there so this is the best way to arrange six regions of electron density around around a central atom and here okay so these four atoms okay these four atoms are in a plane these two are in a in the axial positions now let us see few more molecules okay so let us see this type of molecule sulphur tetrafluoride now first job is to draw the leaves dot structure sulfur has six electrons okay so it's because it is in the oxygen group six plus four into seven seven is a valence electron of fluoride so okay so in total you have 32 electrons how much ah ok sorry 34 electrons in total you have 34 electrons 34 valence electrons are there so you can rather approximate geometry ok you can arrange the sulphur is the central atom and then you can draw um four fluorines around the central sulphur atom so there are four bonds are drawn so eight electrons are gone under eight okay so the remaining is a 26 electrons in case 76 electron can be arranged in this way okay 6 plus 6 plus 18 plus 6 okay so 24 electrons

are gone
so minus 24 electron remaining
so two electrons
so that two electrons should be added
to the central atom
so the remaining left over electrons should be added after filling the
octet of the terminal atoms the remaining left over electrons should be given to
the central atom
now you can say
so this is the correct Lewis dot structure okay it's although central
atom
doesn't obey the octet rule okay
so it's exceeding the number of ok more number of electrons ok so
however we arrange the electron around these atoms using whatever valence
electrons are available now
you can see that
so how many pairs of block now to now to tell the shape of the molecule
you have to look at the number of pairs of electron or number of regions of
so
one two three four there are four bonding pairs and there is one lone pairs
one lone
pair in total there are okay regions electron density phi region
so if you
so you know if you have
a phi region of electrons density the best arrangement is the trigonal
bipyramidal
okay
so you can
so you can draw the ah trigonal bipyramidal geometry of this type
so if you consider these two fluorine atom as the axial positions and these
two
in the equatorial and then put the lone pair in the equatorial positions now
that you
can that i can explain by looking at this model okay
so this is a trigonal bipyramidal arrangement
because you have four five regions of electron density around the central atom
around the
central sulphur atom
so this is a sulphur atom okay and then there are four fluorine atoms
let us arrange them and one lone parabolic answer okay
so there are two ways you can arrange
that okay
so the lone pair this lone pair can be put in the equatorial plane
so this is equatorial
so if you consider this a fluorine fluorine and this is fluorine this is
fluorine
so four
fluorines are there then one lone pair you can put in the equatorial plane
so this is equatorial
because this is the equatorial plane okay trigonal bipyramidal this
equatorial plane
so two
fluorines two fluorines the remaining one the large this position is occupied
by the lone pairs

so you can put the lone pair in the equatorial position
so there is another way you can arrange
that is put the lone pair in the in in this actual position
so that you can draw structure like this
sulfur okay
so you can draw like this
so it is a lone pair ok fluorine fluorine and fluorine and
fluorine okay you can draw
so there is a there are two ways you can arrange lone pair in this sector
okay um the lone pair is okay this is a lone pair
so here it's called lone pair okay
so our
lone pair
so the lone pair is in the equatorial position in in this structure the lone
pair is
in the axial position
so here axial positions so between these are two ways you can arrange now so
between these two structure um what is the actual ah structure or what is the
what is the shape of
the molecule now we have to see the repulsion we can tell predict the shape of
the molecule based
on the repulsion if you have the lone pair in this position that is the
equatorial position the
lone pair is repelled by the bonding electron pair
so this is a bonding electron pair
so this
is atom this is atom in between you have bond that bond means electrons are
there that electron
will be repelled by electron present in the in this region
so that is a lone pair
so there is a
repulsion
so angle between the here and here is 90 okay
so this is a 90 okay similarly this lone
pair is repelled by the this bonding electron pair
so because there is a fluorine there
is a fluorine
so there is another 90 degrees
so it okay if you have a structure
where the lone pair is occupied occupying the equatorial position then you
will have 2 90 degree
repulsions okay let us see how many number of 90 degree persons present in
this structure
so if
you take this is a square uh trigonal bipyramidal geometry you in this for
this structure
this is a you consider this is a lone pair now this if you put the lone pair
here the lone
pair is repelled by the bonding electron pair of this one there is a repulsion
from this bonding
electron there is a repulsion from this one
so it experiences this lone pair experiences 390
degree um repulsion
so it has 390 degree repulsion but this structure has two ninety

degree two ninety degree repulsion okay two ninety degree repulsions
so you have
to choose a structure um okay uh based on the repulsions the structure with
the less 90 degree
okay less repulsion is the best or the favored structure
so between these two this structure is
a favorable structure because it contains um 290 degree repulsion compared to
this structure where
there are 390 degree repulsions
so repulsion is more because there is a more repulsion between
the lone pair and bonding electron pair here comparatively less bonding
electron repulsion okay
bonding electron pair and lone pair repulsions now what is the shape of them m
yes you have
four
so you have two arrangements like this okay the lone pair this is a lone
pair and then you have arrangement like this okay
so lone pair and then okay lone pair and then you have your
fluoride okay
so between these two structure which structure is the correct shape of the
molecule
what is the structure the shape of the correct correct structure of the
molecule is this one
because it has a 290 degree person here there are three 90 degree repulsions
this is the correct
structure character then the shape should be um should be the shape of the
molecule should
be based on the arrangement of the atom not based on the arrangement of the
lone pair then
the shape of this molecule is called seesaw see saw shape okay
so you can
see that what is the shape seesaw arrangement
so that seesaw arrangement
of the okay geometry is based on the arrangement of these fluorine atom not
based on this
lone pair now let us see another molecule okay vr f3 now you have to find out
the draw
the structure of the molecule
so boron boron the bromine has a valence electron seven
plus three into seven okay
so you have 2128 electrons in total the valence
electrons
so arrange them okay
so there are six bonding electrons
so six
minus twenty two
so you can arrange them like that
so 18s are gone
so remaining so
four electrons the four electrons should be added to the central atom here and
here
now this is a lewis dot structure for brf3 now what is the shape of the
molecule
now the central atom contains okay two lone pairs this is one

lone pair this is another lone pair okay see in total
so there are how many pairs of
electrons one two three four five okay five pairs okay of electrons five pairs
of electrons
that means five regions of electrons best way to arrange five regions of
electron density
is trigonal bipyramidal okay stigma by pyramidal
so if you arrange the bromine ah at the central
and then arrange the two flow of three fluorine atom in this way okay and then
this is a trigonal
bipyramidal
so this is a lone pair this is a lone pair okay
so because there are five regions
of electron density
so one as soon as you get five regions the best on the best uh shape
is the trigonal bipyramidal
so you draw the approximate structure now which is the best way
of looking what is the best structure for this
so i in this structure both lone pass on the
equatorial plane you can also have in this way lone pair here is the lone pair
two lone pairs are occupying the axial positions
you can also have arrangement in this way ok
so lone pair okay
so in this structure two
lone pairs are in the equatorial positions in this structure lone pairs are in
the axial positions of
the trio trigonal pi parameter in this structure one lone pair is the in the
equatorial plane
another lone pair is in the axial positions now you have to look at the
repulsions experiential
um by bonding electron pairs or electron pairs now if you look at this
structure ok here the
lone pair lone pair repulsion is the greatest one here you have
so the lone pair is rippled by
this bonding electron pair by two
so there is one here there is one ninety two ninety
degree
so it has two ninety degree repulsions but if you look at this one okay this
lone pair is
rippled by bonding electron pair
so angle is the ah 90
so here is the one here is the one so
similarly here okay there are three for this lone pair similarly for this lone
pair there
are c
so six ninety degree repulsions if you look at this one okay
so this lone pair ok is
rippled by this fluorine atom
so 290 degree and then this lone pair is rippled by this
lone pair
so there are three ninety degree ok there are three ninety degree for this
one
there are 690 degree repulsions
so which structure has less repulsions this structure has the less

number of 90 degree repulsions okay

so that's why this is the shape of the molecule now the shape is a t shape this is called a t shape t shape okay it has a t shape so t shape is um

okay is given to the structure of the molecule based on the arrangement of the three fluorine

atoms not by the arrangement of the lone pass okay

so uh in addition one can also explain

the structure actual structure of this BrF3 based on the lone pair lone pair repulsions lone

pair since lone pair wanted more volumes okay so the best place for that to uh is to occupy the

equatorial plane because in the equatorial plane the angle between the atom two electron density

here to here is 120 degree okay

so it is far away from each other if you put the lone pair on the actual position the angle is 90 degree

so the best way to put the lone

pair is in the equatorial plane that gives the structure of lower energy so that's why the shape of this BrF3 is a t-shape okay ok its a t shape because it looks like a t

ok this is a t

so this is one terminal this is another terminal atom this another terminal atom

this is a middle atom

so its a t shape thank you you