good morning let us continue our discussion on mo
diagram for other molecules
so far we have seen mo diagram for h2 and then helium 2 and
then li 2 and then similar diagram you can draw for beryllium 2.

so let us see
more about mo diagram for other molecules it is important to remember that in
molecular
orbital theory that mixing of orbitals ok
so you have one energy level um for example
you have one s orbital of one atom and it is represented like that you have
one s orbital
up for another atom ok it has one s orbital and these two energy levels atom a
this atom b the
its energy level is here and they have same almost similar energy atom okay
oneness orbital on atom
a bonus orbital atom b have the similar energy that's why they are able to
interact and you will
get two mo diagrams the mo and molecular orbital energy levels which are
represented in this way if
how many number of electrons are here for example two are there then they will
go here two will go
here and then two more will go here
so at the end you you can count the number of electron at the
molecule
so the here is the the middle one is the molecular orbitals these are the
these two are
the atomic orbitals contributing atomic orbitals the number of molecular
orbitals is same as the
number of atomic orbitals combined to give them
so number of atomic orbital is one two number of
molecular orbital is 1 2 and number of electron also remain remains the same
so 4 electrons are
there number of electron is 2 plus 2 4 electrons
so this is a atom for helium because it has
um four electrons are there say this in the same way if you have energy levels
okay so
if you have oneness orbital oneness orbital um orbital they interact and get
molecular orbital
of this diagram and if you have two s orbital two s orbital after oneness you
have two s
orbital and then you have like that and they also interact each other and then
you will
get mo diagram like that ok
so for example after helium you have a lithium li-2 and then you
have beryllium let us see beryllium be2 and then you have your two electron
here you have a two
electron both of them will go here and both will go go here in addition you
have beryllium one
electronic configuration you have to remember for one beryllium atom one has
two two s two s
two ok two s two
so the number of electron is into two
so equal to eight electrons are there

so four electrons are given here
so another two more ah electron here here two more electron and
then you have to fill up and then fill up here
so number of electrons in b e two is eight
electrons two plus two plus two plus two eight electrons and then the bond
order is these two
this is a sigma orbital this is sigma star orbital again this is sigma orbital
this is sigma star
orbital to find out the bond order this these two are cancel each other and
these two cancel
each other
so there is no bond between um no bond in b two
so that means it doesn't
exist b two like helium does not exist let us see other molecules after
beryllium ah you have boron
so if you look at the boron mo diagram as
usual you can write if you this is oneness orbital of the boron atom
so let us see b boron
b2 electronic configuration is 1s 1s2 2 s 2 2p one okay
so two borons means ah phi into two so
number of electron is ten electrons are there
so oneness orbital you draw here another oneness
orbital of another boron atom here is the boron atom another boron the middle
is the b2
so you
have two electron here and then two electron here they interact each other and
you will get
two mo diagrams which are connected in this way and then um ok this is oneness
or beta
after that you have um two s orbital two s orbital they interact and then you
will get
like that ok after that you have ah two p orbital two p orbital
so in two p orbital there are two
types of orbital they can also form a sigma bond as well as pi bond
so you have in in in image
you have p x p y and then p z the p z is for is for forming sigma bond these
two for pi bonds
two pi bonds can form using p x p y orbital so they interact each other and
then you will have
because ok interact to give one sigma bond and two pi bonds can form using
three two p orbital as we
um you have studied that sigma bond is higher in energy
so that will be in lower energy ok
so then
after that a pi bond comes because his energy is higher because overlap is
less
so it is usually
placed here then you have to draw like that and then draw like that then for
this two and these
two and then you have your ion d bonding pi star orbital and then a sigma star
orbital
so this is a
sigma orbital formed by oneness orbital this is a sigma orbital formed by um
oneness orbital this

is a sigma orbital formed by two s orbital this is sigma sorry this is sigma star this is sigma
star orbital formed by two s orbital this one is the sigma orbital formed by two p orbital this one
is the pi orbital that is p x and p y orbitals are there
so pi orbital formed by two p orbitals two
p orbitals okay
so this is a ah pi star orbital formed by two p orbital this is a sigma star orbital formed by um two p z orbital okay
so this is two p z sigma orbital formed by two p z orbital
sigma star orbital is formed by two p z orbital so now if you fill up for boron as um as we have
seen before now what we have done here is the mixing of oneness orbital with oneness orbital
two s orbital with the two s orbital two p orbital with two p orbitals
so we mixed them and we drawn
the energy levels accordingly um okay now you fill up the electrons ten electrons are there to put
here two foot here because two also another one is the ah two s two
so there are two here there
are two here the both of them okay all four will go here on top of that two p orbital there is
one electron here it can be here it can be here then you have to put here because it is the this
orbital lower energy now if you look at that now both electrons are in one orbital that is sigma
orbital now that means the molecule is ok the molecule is a diamagnetic as of now actually it is
not diamagnetic excellently b2 is not diamagnetic that means there is electrons are paired up
diamagnetic means electrons are paired up paramagnetic means there is a presence
of at least one electrons
so b2 is is not diamagnetic actually
experimentally experimentally x-mentally b2 was found to
be a paramagnetic molecule okay b two is a paramagnetic magnetic molecule so if you fill up the molecular orbital diagram in if using this energy levels this type of
energy level you will end up with the wrong conclusion about the b2 bond order
if you want to calculate bond order order equal to number of bond
so these two cancel
these two cancel and then about here there is a two electron in the bonding orbitals
so there
is no electron in the antibonding orbital
so two divided by two equal to one bond order is one
that is correct but the nature of the molecule is not diamagnetic it is a paramagnetic ok
excellently observed that it is a paramagnetic b2 is a paramagnetic then that means the the
diagram which we drawn just now is is is incorrect
so what is the energy level correct energy level
diagram even if you go for example ah okay it it failed to um explain our

experimentally observed
phenomena okay excellently what is observed is a paramagnetic which is not supported by the this
theory
so then let us look for the whether it is a case same case for c2 molecule for next molecule
is after boron you have a carbon c2 molecule there the number of electron ism is a 12 12
electrons are
so 12 electron will go here ok after filling up these two energy levels are degenerate
ok
so these two energy levels are degenerate that means they have equivalent in energy ok
so so
when they are equivalent energy two electron two remaining two more electron to the per
carbon c2 two more electrons are there ok
so those two will go to these two orbitals
one by one ok according to whoms rule of maximum multiplicity and then you will end up with the
conclusion of paramagnetism
so as per this diagram you will see that you will you can predict that c2 is a paramagnetic actually it is not paramagnetic it is a diamagnetic molecule then that means this
diagram is not a suitable diagram to explain the experimental observed properties of certain
molecules for example at least b2 and c2 then what is the correct diagram to explain the
property okay to see to before we draw what is the correct diagram we have to understand okay
the concept of mixing ok
so mixing of orbitals mixing orbital mixing of orbital is possible as long as energy levels are similar and symmetry
is same okay for mixing of orbital two condition primarily two conditions are required ok
energy levels energies ok energies are similar and symmetry of the orbitals which
are mixing should be the same symmetries the same ok as long as these two conditions are met ok
mixing can take place
so what we have drawn here is the mixing of oneness orbital with oneness orbital of another atom two s orbital of the ah of one atom with two s orbital
so because these two
energy levels are ah similar or equal
so that's why mixing takes place between these two s orbital
two s orbital ok now there is also if the energy is
so big but there is no mixing between oneness
orbital and two s orbital because the energy levels the energy difference between oneness
orbital two s orbital is very large there is there is no mixing between oneness orbital two
s orbital ok but if there is um if they are in closer energy there will be mixing thats what

happening for elements on the left side for for l two ok or for a lithium two lithium two ah
n two molecules for lithium t and two molecule there is a significant mixing of two s orbital
with two p orbitals there is a mixing between two s orbital and two p orbital of one atom within
one atom as a result when there is a mixing happen and then when they interact each other energy
levels are reversed
so how it can happen because actually the mixing depends on effective nuclear
charge that is represented by these sauce g z star which is lower than the actual nuclear
charges
so this is called effective nuclear charge okay
so that effective nuclear charge increases
from left to right ok
so when you go from lithium to okay fluoride lithium to fluoride the
effective nuclear charge that is z star increases increases when the nuclear charge increases okay
that is nuclear charge means the power to attract electron towards itself okay
so that increases
from lithium to fluoride when it is increases okay the electron present in different orbitals
are attracted towards nucleus in different ways
so you have after um nucleus after the
nucleus you have one s orbital and then you have two s orbital and then ok
so you
have two p orbitals okay after the nucleus
so these orbital electron present in these
orbitals are attracted towards nucleus in different ways or are in different attracting
different um different extent as a result as a result ok
so they are pulled towards each
other as a result there is a mixing between 2s and 2p orbital for elements located on the
left side for example l i 2 n 2.
if you go to o2 you have to okay the nuclear charge is increased
so uh
so the mixing is less for here because on the the gap between 2s the
2s and 2p gap is large okay
so no mixing mixing for these elements for this for these
elements for these molecules or elements there is no mixing of 2s2p orbital what is the reason the
energy gap is more why energy gap is more because nuclear charge is higher when nuclear charge is
higher okay 2s orbital is pulled more compared to 2p orbital
so that means the gap is increased
when the gap is increase energy difference is more there is no mixing that is what happening
for the elements located on the right side but that is not the case for the elements located on
the left side because there the nuclear charge is ok less

so that means two s and two p orbitals are
not attracted as much as ok is not attracted as much as attracted for elements of this type
so um
so as a result there is a mixing for these elements when there is a mixing 2s orbital
2p orbital mix and then when they interact energy levels are reversed
so you
can see that if you draw a diagram i am going to draw only the 2s orbital this is a
2s orbital you have another 2s orbital of another atom ok
so there is a energy level they interact
and then they form then you have a 2p orbital you have here two p orbital you have
a two p orbital here and then as usual ok there is a bond ok there is a double bond
ok pi bond this is sigma orbital this pi orbital and then on top of that you have a pi r
beta and then sigma orbital
so you draw a diagram here and you can show the interaction in this way
and then you can show like that and you can show because now ok some there is a mixing between
2s and 2p orbital then this is sigma star this sorry sigma this is sigma star orbital this is
pi star orbital okay this is sigma star orbital bk okay
so because the new effective nuclear
charge is less for elements located on the left side there is a mixing between 2 s and 2 p
orbital
so let us see that this type of initially this type of energy levels are formed
so because
of mixing this sigma orbital is mixes with the sigma orbital formed by two p orbitals so
there is a mixing okay there is a mixing okay mixing between molecular orbital formed by
two s orbital sigma orbital molecular orbital formula two s orbital and the sigma orbital formed
by two p orbital they mixes
so as a result the higher energy level this one is increasing energy
the lower energy level sigma orbital is decreased energy when this is increase this decrease the
pi orbital remains a size
so as a result there is a reversal in the order of orbitals molecular orbitals that i can show you in this way
so keep this energy level as such okay
so you have two
open
so draw the diagram corresponding to this one two p orbital this is two p orbital accordingly
you have a two p orbital here and then you have yeah okay
so 1s orbital sorry 2s orbital here you
have a 2s orbital 2s orbital now because of mixing this energy level ok this energy level this

this sigma orbital formed by 2p orbital okay is mixes with him ah sigma orbital form formed
by two p two s orbital because it is located in higher energy it goes up and this is lowered
in energy
so there is a reversal
so when this goes up ok
so that is it goes here okay there is
interaction here and the interaction here and then ok
so this level can be decreased here and there
is a decrease and then you have a sigma orbital formed here and then after that you have a pi star
orbital after that you have a sigma star orbital this is a sigma star orbital from a two s orbital
and this mixing after mixing this is a result this is sigma star orbital this is pi orbital this is
sigma star or sigma orbital this is sigma pi star orbital this is sigma star orbital
so you can see
here there is a reversal in the order of molecular orbitals here when there is no mixing sigma
orbital is lower energy when there is a mixing sigma orbitals higher energy compared to the pi
orbital ok
so this sigma orbital is resulting from mixing of two s orbital and two p orbitals
so you have to show the diagram from two s to here and here and then here and then here you know
what to show
so it is a sigma orbital formed by two two two p orbital as well as two s orbitals
so that means it has character of both two s and two p orbitals and pi orbital energy level
is not affected ok because of this interaction this orbitals increase energy this orbital
lower energy ah giving this type of mo diagrams now this is the energy level present in elements
present in the left side in the left side
so if you fill up this diagram this type of
diagram using number of electron present in boron atom then you will end up with the correct
diagram and supporting the excellent observed um property of that molecules
so if you take a
molecule for example b2 number of electron is a 10 ok
so 4 already consumed for example
so you have
um okay let me show you in another diagram
so you have um oneness orbital of bora
so let us say
construct a diagram for b2 again
so this is a 1s orbital oneness orbital they
interact and then energy ok energy level is formed and then on top of that you
have ok

so you have two s orbital two s orbital ok and then they interact ok because of um mixing
ok
so you have lower energy pi orbital and then sigma orbital the contributing orbitals are two p
orbital ok
so they are corresponding to p orbital
so this has here on top of that you have
pi orbital on top of that you have a sigma's orbital this is pi star orbital
so this
one is a sigma orbital formed by 2s orbital as well as 2p orbital
so you have to show the diagram
there it is there for b 2 number of electron is 10 here 2 2 here
so it is two here two here they
cancel each other for bond order calculation purpose here there are two electrons here there
are two electrons
so two gone here two gone here now ok there is one electron because electronic configuration of boron is one s two one two two s two two p one
so number
of electron total number of electronics are ten there are five electron in each boron atom
so here there is one here is one
so both of them there are two electrons are available and
there are two degenerate orbitals are there then both electron will not go to the same orbital then
there is another orbital available which is having equal energy that is this these two orbitals
are called degenerate orbitals ok
so equal in energy and you have number of electrons two only
so both electron will not go into the same orbital ok according to the hunts rule of maximum
multiplicity electrons are occupied if energy levels are equivalent electron will go to each
orbital one by one they are occupied separately
so two electron two molecular beta
so two
molecular orbital degenerate molecular orbital one here and one here then ok
now the bond order remains the same ok bond order is one but the molecule nature of
the molecule is changed now it is a paramagnetic
so because there are there are two unpaired
electron one here one here this is a pi orbital formed by ok this is the pi orbital formed by p x and p y orbitals this is a sigma orbital formed by two p sigma
ok this is a two p z orbital
so ok there are two electrons in these orbitals the bond
order is one the molecule is paramagnetic now ok now this diagram explain the extremely observed
property of the b2 that is paramagnetic in the same way you can fill up the diagram for b2
for for for c2 here the number of electron is 12 electrons number of electron is
so 12

now already we filled up in this diagram ten then two more will go here okay now when you
fill up these two because this is higher energy this is higher in energy
so these now it
explained that the c2 is is a diamagnetic okay c2 is c2 is diamagnetic and the bond order here equal to
so bond order purpose these two cancel each other these
two cancel each other and then you have a bonding orbital
so there are four electrons the
antibonding orbital there is no
so bond order is equal to number of by electron present in the
bonding orbitals molecular orbital that is four minus zero divided by two ok equal to two the bond
order is two for c two now this diagram explain the property actual property of the c2 which is
diamagnetic
so this is a actual diagram should be used correct diagram should be useful for
explaining the property of um c2 or b2 molecules ok now you can also fill up this energy level
diagram for n2 here number of electron is 14 electrons are there some electron from
each nitrogen atom
so two more electron compared to this one
so those two electron will go
to here okay now i am removing this because we are changing that and now fourteen electrons are now
fourteen electron you can count two two two two so eight ok ten twelve fourteen fourteen electrons
are there now the for n to the bond order equal to number of electron present in the
so these
two cancel each other you have six electron the bonding molecular orbital
so six minus zero
by electron in the antibonding multiple orbital divided by two equal to three
so there is a n2 n
n n triple bond between two nitrogen atom triple bonds present in between two nitrogen atom and
the molecule is diamagnetic no problem here where molecule is diamagnetic you can explain
that now there is some um this is the energy level diagram for elements um from this is a
suitable energy level diagram for elements l i 2 n2 now let us see the energy level diagram for o2
for for o2 okay for as usual you can start with 1s orbital 1s orbital interact two energy levels
are formed and then you have okay two s orbital okay two s orbital interact and then energy
level is level formed and then you have a um pi ok you have um a sigma orbital there is a
sigma orbital then pi orbital
so you have a two p orbital you have a two p orbital
so a
pi bond is formed as well as pi star orbital ah phi star orbital also pumped

and then this is
sigma star orbital
so this is formed here in this way and you can construct a molecule here is a
o here is the o this is o here this is the o2 now electrons here is the eight electrons are
there okay eight electrons here there is eight electrons in total sixteen electrons two here two
here here here and here here here here and here and now here energy levels is the first orbit
outcome when when you come to here this is a sigma orbital formed by um 2p orbital and this is
a pi orbital formed by two pier beta now you see here the sigma orbitals lower energy compared to
pi r beta because nuclear charge is more for o2 as a result there is no mixing between two s and 2
p orbital okay
so there is no mixing when there is no mixing sigma orbital is lower energy compared
to pi orbital
so you have to fill up the diagram according to this um fill up this diagram um using
the number of electrons
so 18 electrons are so you have to fill up here and here and here and
here and then two more electron will go to here
so now these two energy levels this is pi star
orbital ah formed by two p orbital this is sigma star orbital formed by um two p orbital ok so
number of electron is sixteen two two two to eight um eight ten ah 12 14 16 16 electrons here ah when
you put the two or more two more electrons because these two energy levels are degenerate orbitals
so these are molecular beta should be occupied one by one
so you have two unpaired electrons so
o2 ok two unpaired electrons two unpaired electron two unpaired electron that means o two is a paramagnetic yes that is correct go to oxygen
is paramagnetic nature now here i want to find out that what is the status for as far as valence bond theory is concerned according to valence bond theory electrons
would be paired up when there are two bond bonds between two oxygen there is a two bonds that
means the maximum number of electrons are fired up
so valence bond theory predicted the oxygen
molecule as as has a diamagnetic because electrons are paired up valence bond theory according to
valence bond theory o2 should be a diamagnetic because the stress in valence bond theory is on
pairing electrons wherever for bond formation electrons should be paired up you need two two
number of electrons for formation of one bond that is a basic concepts of ah balanced
bond theory okay
so as as ah
so as per its um principle balanced bond theory predicted that

it is a diamagnetic
so it is not diamagnetic it is actually it is a paramagnetic
so this is the one
of the failures of valence band theory to explain the actual molecule that is why another theory is
this theory that is molecular orbital theory was developed which explain what is observed um
accidentally
so balance point theory predicted o2 as a diamagnetic parameter okay but actually
it is a paramagnetic that can be explained only by mo diagram molecular orbital diagram
because you have two electrons here to one per electron one electron in each pi star orbitals that's why o2 is a paramagnetic
so you in molecular orbital theory you just
calculate to find out the what is the bond order you have to find out number of electron present
in the bonding molecular orbital minus number of electron percent in the antibonding divided by
two
so what you need is ok according to molecular orbital theory ok one electron is sufficient ok
enough one electron is c enough for bond formation ok
so one electron is sufficient for bond
formation but in valence bond theory you need to have two electrons for bond formation that is a major difference
so this is a now another concept which i
would like to introduce here is the what is homo and then what is lumu homo is the
highest occupied this means highest occupied molecular orbital
so lumo means lowest unoccupied molecule orbital
so what is homo lumo here for oxygen molecule
highest occupied molecular orbital is five star orbital that is ah sorry highest occupied almighty
what is lumo lowest unoccupied molecular lowest unoccupied molecular orbital sigma star beta so
that is what that is how you can identify which is homo which is lumu homo is the molecular orbital
ok occupied highest occupied molecular orbital for o2 is 5 star orbital because this is the orbital
occupied
so on top of that you have your lumo which is the lowest unoccupied molecule
so on top
of this there are some more orbital on top of this there are some more orbital which are not shown
here
so this is the first unoccupied molecular operator that is that is called lowest unoccupied
molecular beta highest occupied molecular metal is this one lowest unoccupied unoccupied molecular
orbital is this one that is lumo
so this is a lumo this is a homo for o2
so it changes as
that you can find out based on the occupancy of the orbital you can find out

for every
molecule which is lumo which is um homo now now
so you have molecular orbitals now
suppose this is a energy level diagram for o2 now the same way you can fill up molecules such
as um f two ok number of electron is a ok its its eighteen electrons are there because
9 electrons from each fluorine atom
so both remaining 2 more electron will go to these two
so the bond order is now will change to 1 because the boundary number of electron changes
in the um antibonding electron is changing so bond order is one
so similarly you can fill up
for any two um
so that two more electron will go to this one and there is no bond between two
ok neon atoms and that molecule does not exist now suppose ok
so this is the energy level diagram
it is you know that that ok there are species o2 2 minus o2 minus and o2 plus here 2 electrons
are added because you take a o two plus two electron you give then you will have o two two
minus it is a peroxide ion and similarly and and then if you look at the bond length and bond
order here for o2 the bond um okay the bond order bond order is 2 the bond length is equal to 121
meter ok and then two more electrons are gone given to the o2 and then it is for found that
the bond adder is ok here the bond order is one ok and then bond length is a bond length is
149 picometer ok
so 2 minus
so 2 minus means 2 electrons 2 minus equal to 2 electrons where
does where where do they go
so when this is a bottle molecule you give electron two electron to
o2 those two electrons will go to ok the arbiter molecular orbital ok which is not occupied so
if you look at these orbital which are singly occupied that means there is a space
so though
both electron will go to this pi star orbital when electrons are added to the pi star orbital it is
going to affect the bond order
so the bond order when you do when you when you draw calculate for
for for o to two minus now i am drawing only the um outer most electronic configuration molecular
orbital configuration
so you have a two p orbital two p orbital then you have m as sigma orbital then you have pi orbital pi orbital sigma orbital ok o two means here two more electrons this
is o2 2 minus the number of electron ism 18 electrons are there okay because in o2 in
o2 number of electron is a 16

so in ah in o2 2 minus means 2 electrons
so 16 plus 2 equal to
18 electrons that has ok that will go here in this way in this way filled up
and then here here
here and here
so filled up now if you calculate the bond order for o2 equal to number of
electron
present in the bonding molecular orbital it is six ok number of electron
present the antibonding
orbital this is phi star orbital this is a pi orbital this sigma orbital this
is sigma star or
beta
so six okay number of electron percent in the bonding molecule total minus
and the bonding
electron four divided by two ok
so you will have ok
so one the bond order is one two by two equal
to one
so that is why i written here when you give two electron to o two it becomes
o two two
minus ok the bond order is 1 the bond length is 149 whether it is lower higher
compared to the
starting o2 the when you compare the bond distance found in the o2 it is 121
picometer only now after
giving 2 electron the bond length is increased to 149 what is the reason
because electrons are added
to the antibonding orbital whenever electrons are added to the antibonding
orbital bond length bond
order decreases bond order is decreases when the bond order decreases bond
length increases
length is increase
so as you can see here here bond order is two bond order is one okay
so bond order when bond order is higher ok its length length is ok 121 ok and
when bond order is
increase or decrease to 1 bond length is increased that is 149
so let us see if you have o2 minus
superoxide now one more electron will go to if you consider for one boom go to
minus you
have you have to put only one electron minus means one electron that will go
to ok here so
you will have for o to minus the bond order equal to six minus number of
electron present in
the antibonding orbital is three divided by two equal to three by two equal to
one point five ok
so the bond order in this case for o two minus bond order equal to one point
five and the
volvo distance was found to be 126 picometer similarly you can have okay o2
plus that means
okay electrons are removed from o2 which electron will go away the electron
present in the highest
energy levels
so if you want to make your o two molecule o two plus molecule o two plus
molecule
that means one electron is less compared to o two

so that which electron will go away if
this is it is this electrons will go any one of this electron because they are degenerate one
of the electron will go away now you can calculate the bond order that is six minus one that is
five by two that becomes bond order becomes 2.
5 okay for o2 the bond order equal to ok 6 minus
number of electron present in them and the bonding orbital is 1 divided by 2 5 by 2 equal to two
point five is the bond order then over distance equal to in o two plus is one one picometer now
i am going to summarize them okay now ok
so if i if i summarize them the highest bond order is
found for o2 okay
so o2 plus is has the highest bond order then you have your o2 then you have
so o2 minus and then you have o2 2 minus okay the bond order okay is here it is 2.
5
here it is 2 here it is 1.
5 here it is 1 only then bond length if you look at it ok it is
1 1 2 it is 121 126 this is 149 picometer
so you can observe relationship
between the bond order and bond length ok
so the bond order increases bond ok so
then as it increases ok this decreases bond length decreases
so as it decreases
so increases
okay
so this increases ok
so then it decreases okay bond length decreases
so as the bond order
increases bond length decreases in this as shown by this way and and and also you can see here o2
the bond order is okay two if you go to okay o to two minus bond order is one here it is one point
five that is in between these two
so that also you can see here the bond length is one forty one
forty nine here bond length 121 1.
5 is between two and one
so as similarly the bond length also
between 121 and 149 that is 126 observed 126 picometer
so so you have to remember that when
electrons are added it will go to the highest orbitals that is in case of o2 it will go to the
anti-bonding orbital when electrons are added to the antibonding orbital bond order decreases
so when electrons are removed from the o2 it is the highest orbital electrons is removed
so it
becomes
so when the highest orbital in o2 is the pi star orbital when electrons are removed from
pi star orbital okay then the bond order increases that's why in o2 plus the

bond order is 2.
5 when
electrons are added to the end burning orbital bond order decreases that's why would in o to 2
2 minus the bond order is 1 bond length is longer
so you have to remember plus means minus electrons minus minus means addition of electron
plus means subtraction of electrons
so you have to use two types of
diagrams
so if you want to use for ah for atoms lithium li-2 and two
you have to use this type of diagram orbital oneness orbital and then you have a 2s orbital this is a 2s orbital this 2s orbital orbital ok
so you have two s orbital here and then you have one s and two s orbital and then you have one as orbital and then you have a pi orbital
and then there is a sigma orbital then is it is a two p orbital this is two p orbital and then
that interact and that retract and it is interact and this is also you have to draw a line like
like that and then there is a pi orbital pi star orbital there is a sigmas orbital here now
so this
is a diagram should be useful for molecules from li 2 to n2 as you can see here okay
so as
usual there is a sigma sigma star beta but pi orbital energy level is lower compared to
sigma orbital higher this is higher in energy compared to pi orbital for molecules from o to
two you have to you have to use this diagram is two years this is two years then
you have a sigma orbital two p orbital two p orbital and then you have pi orbital
so this is a molecular orbital diagram should
be useful for o22 you have to for li to n2 this is the energy level diagram if you mix and use it
then you will not get the correct result and then you will be predicting paramagnetic molecules
diamagnetic diameter and vice versa thank you you