in this video
i am going to discuss about chemical
bonding and molecular structure the
concept of resonance and resonance being
structures in various inorganic and
organic molecules
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this video includes the brief outline
about the resonance in chemistry
some resonating structures
resonance structures and isomer the
difference between the regenerating
structures and isomers
then i will talk about the significance
of the resonance
and
i would summarize it
at the end of this this video intends to
describe the resonance in organic and
inorganic molecules
and complement the significance of
resonance in molecular structures
the resonance or mesomerism is an
approach describing the bonding in
certain molecules or iron by the
combination of several contributing
structures
into a structure that is called as
resonance hybrid
so structure one
or some structure two
it is very difficult for us to
understand
the difference between structure one and
structure two it just look like its
mirror image right so this structure
both the structures can be represented
together
as a resonance hybrid
with this double bond as it is shared
between these three atoms
right so that double bond constitutes
some electron density so it can be
between these three atoms represented by
dotted lines
the term resonance earlier was referred
to partial variance hypothesis by
jonathan in 1989
he explained the resonance with the help
of benzene
as we know
in benzene
we have
three double bonds but these three
double bonds can be located differently
like if i number this as one carbon then
from one to two there is a double bond
then three to four there is a double
bond and five to six there is a double
bond but here at one carbon

one to two there is no double bond but
two to three there is double bond
three to four there is no double bond
but there is
four to 5 there is a double bond and 5
to 6 there is no double bond but 6 to 1
there is a double bond so it is very
difficult to
locate this
so this can be represented as
a resonance hybrid
where we draw the
cyclohexane molecule and in between we
put a dotted line or a circle
that shows there is a
continuous delocalization of this
electrons from this point
from
this shows there is a delocalization of
the electrons in cyclic manner
this is another example of an organic
molecule a allyl carbocation
carbocation is formed by a loss of one
hydride ion here
from the ch3 group then there could be a
resonance
happening by the delocalization of this
electron
from here to here and if this switch is
over here since there is a positive
charge this positive charge will develop
on this atom
this carbon atom here so that is
represented here this both the
structures structure one and structure
two can be represented as
hybrid or resonance hybrid structure
which is represented here
now this resonance does not occur only
in the
organic molecules but it also occurs in
in organ chemistry for example in the
nitrate diet as we know
nitrogen is bendable in nitrate ion
where two oxygen are having the double
bond where one oxygen is
having a single bond with nitrogen
and the charge on one oxygen atom is
there negative
now
there could be a delocalization of the
electron this
electrons can form a double bond
these electrons or this lone pairs on
the oxygen external lone pairs
can be utilized to form a double bond
okay
and
in that case here there is a
delocalization of this electron and they
will move to this oxygen giving the
negative charge to this oxygen atom

similarly there could be a
delocalization again and we can have
like this three
resonating structure structure one
structure two and structure three for
the nitrate ion and the resonance hybrid
can be represented as
this way the dotted line indicates
there is a
equal sharing of the electron density
between these four atoms
energetically this all the structures
are equivalent
let us try to understand the difference
between resonating structures and the
isomers
so the resonating structures here
i have shown an example of a ozone
molecule this ozone molecule differ only
in the
arrangement of the electron density
between these three oxide atoms like if
i number this oxygen atom one two three
then there is a lot of electron density
because of double bond between the one
and two oxygen atom while in the other
other structure
we see there is a electron density more
set between the
oxygen two and oxygen three so here
this is one these two structures only
differ
with the
electron density
but if i can take trans one two
dichloroethylene
and one one dichloro ethyl
they differ
in arrangement of atoms here
the
molecular formula is same for both the
molecules but the arrangement of the
atoms is different
similarly we can also have a cis
dichloromethane which will be also a
isomer not a resonating structure for
this molecule
so resonance structures are the
structures which only differ with the
electron density okay their placement
with the electron density
so this two structures are not
equivalent
while these two structures
are equivalent
these two structures
the isomers
one one dichloroethylene and trans one
two dichloroethylene
are energetically not equivalent but
this
resonating structures of ozones are

energetically equivalent
let us try to understand the
significance of the resonance
if we take example of a carbonate
molecule
in carbonate molecule there is one
carbon and oxygen which is double bond
and there are two oxygen atoms which are
singly
which have a single bond with the carbon
now there could be delocalization and we
can have a number of resonating
structures
now if we observe the carbonate
ion together has a
minus two charge
so this electron density on this oxygen
atom is there this oxygen atom is there
this oxygen atom in this structure is
there like that there is lot of electron
density on this oxygen atom and when
there is electron density only on one
atom these structures tend to be less
stable
but in the resonance hybrid
it is
the charge is distributed
[Music]
this minus two charge is distributed on
three oxygen atoms
so
this
[Music]
hybrid structure is more stable than
this any of this
contributing structures
the overall energy of the molecule is
actually reduced since electron density
is distributed between many atoms so
more the resulting resonating structures
more will be the stability
so in summary resonance structures are
useful when a single level structure
cannot completely describe the bonding
in molecule
the systematic representation of
possible resonance structures is defined
as resonance hybrid
and the molecules with more number of
resonance structures
tend to be more stable
than with the fewer structures and some
resulting structures contribute more to
the stability of the molecule
you can read
you can read more about this concept in
this books
thank you