hello students i am mrs varsha dinesh
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i will be taking up the
bachelor of science program in chemistry
semester 5
CHC 106 inorganic chemistry in this unit
the name of the chapter is
periodicity of elements
and the property of one of the
periodicity of elements which i will be
undertaking is electronegativity
and in specific the subtopic pauling
scale
with calculations so the outlines of the
topic
are the main topic is electronegativity
and the sub topic is pauling scale with
calculation
so at the outcomes we will see that at
the end of the module
students will be able to number one
define the periodic property
electronegativity
number two relate the elements of the
periodic table
in terms of electronegativity values by
using the pauling scale
and number three determine the values of
electronegativity
of different elements using the pauling
methods
now what is electronegativity let us
define it
a qualitative measure of the ability of
an atom
to attract the shared electrons to
itself is called electronegativity
the term electronegativity was
introduced by jacob
berzelius in 1811 though the concept was
known even before that
electronegativity is a qualitative
measure
because unlike ionization energy and
electron affinity
which is related to the atoms in the
isolated gaseous state
electronegativity is in the bonded state
and hence not
a measurable quantity what is the
pauling's approach
there are actually three approaches i
will be taking up only one approach in
this module
that is the pauling's approach how has
pauling defined electronegativity
pauling defined electronegativity as the
power of an atom in a molecule
to attract electrons to itself the
pauling scale

is the most widely used scale pauling
scale
is a numerical scale of
electronegativities based on bond energy
calculations
for different elements joined by
covalent bonds
the range of values for pauling scale of
electronegativities
ranges from fluorine which is most
electronegative
which has a value of 4 to cesium which
is the least electronegative
which has a value of 0.79 hydrogen which
is the first element in the periodic
table
has been given a value of 2.2
let us now go to the calculations
paling calculated electronegativities
from thermodynamic data
he has used two concepts one is the
concept of
arithmetic mean and second is the
concept of geometric mean
so we will see how both the concepts are
used
and which one will give us better values
of electronegativity when we use the
concept
so using the first concept he considered
that
in a reaction of the type half a dash a
plus half b dash b will give us a
molecule a b
this is equation one then the difference
in the electronegativity of the
combining atoms
xa minus xb is equal to electron volts
raised to minus half the whole root e
dash a minus b minus
the mean of e a dash b plus e b
dash b where e a dash b
e a dash a and e b dash b
represent the bond dissociation energies
of the molecule a b
of the molecule a dash b and the
molecule b dash b
respectively and x a and x
denote electronegativities of a and b
respectively the factor electron volts
the whole raised to minus half being
included
to include a dimensional result example
let us take an example of a real life
molecule
where we have a molecule of hydrogen
where we will take one atom of hydrogen
then we have a molecule of chlorine we
will combine it with
one atom of chlorine where we will get a
molecule
hcl so where the electronegativity of

chlorine is given as
xa and electronegativity of hydrogen is given as
xb thus continuing
xa minus xb is equal to just rearranging the equation so we bring down
eb minus half in the earlier reaction we bring it down so it becomes 1
divided by root of ev then
root of e a dash p minus the mean of
e a dash a plus e b dash b
this is equation three then going to the next equation
we square up where we have x a minus
x b the whole square is equal to 1 upon
e v e a dash b
minus e a dash a plus e
b dash b the mean that is equation number four
now what is the value of one electron volt so if you want
you can take the value of the electron volt in kilocalories per mole
or you can also take the value of electron
atoms in kilojoules per mole
so what is the value in electron volts per atom
is 23.06 kilocalories per mole
and in terms of kilojoules it is 96.49
kilojoules per moles the bond dissociation energy of
a dash b that is molecule a b is higher than the mean of the bond dissociation energies
of a dash a and b dash b
and their difference referred to as delta
is also known as ionic resonance is related to the difference
in the electronegativities of a and b
therefore equation 4 can be now rewritten as
23 xa minus xb the whole square
is equal to delta so from where did we get this 23
we have to substitute the value of electron volt per atom
if we are taking in kilocalories per mole if we are taking it
in kilojoules per mole then we have to substitute 96.49
so then again xa minus xb taking the square root
we will get 0.208
root of delta this is equation six
now the second concept is the concept of the
geometric mean now what has he done in with regards to geometric mean he considered that in a reaction of the type

it is a similar reaction as you have
seen when you are considering
also for the arithmetic mean half a dash
a
plus half b dash b will give us the
molecule
a b so it is the same way as has been
done for the arithmetic mean
but only now the difference is since
we are taking in terms of geometric mean
there will be an extra factor which is
to be added
so what is this factor which is 1.3 so
now we can write the equation
1.3 xa minus xb the whole square
is equal to 1 upon electron volts
e a dash b minus e a dash a
now instead of addition instead of the
arithmetic mean
we are multiplying because it is the
geometric mean so multiplied by
e b dash b so then equation 3 becomes
1.3 into 23. now again from where did
this 23 come
this 23 is what is the value of electron
volts
it is in terms of kilojoules or it can
be also in taken in terms of kilo
calories
so 1.3 multiplied by 23
xa minus xb the whole square is delta
prime
so the earlier one we have taken
arithmetic mean as delta
so we have to differentiate and let
people understand
so we have taken this as delta prime so
that you differentiate
between arithmetic and geometric mean
now again as i have told earlier the 1.3
factor is due to the additional energy
that comes
from ionic factors that is the polar
character of the bond
now 1.3 multiplied by 23 will give us
29.9
it can be rounded up so we will get 30
xa minus
xb the whole square is equal to delta
prime
this is equation number four and the
final equation
is the difference in the
electronegativities xa minus xb
is equal to 0.182
the whole root of delta prime this is
equation 5.
so we have seen both the approaches
using the arithmetic mean
as well as the geometric mean now the
final discussion
the geometric mean is approximately

equal to the arithmetic mean
when the bond association energies are
of the same value
when there is a larger difference of
bond dissociation energies
the geometric mean is more accurate and
almost
always gives a positive energy excess
due to the ionic bonding thus values of
electronegativities determined by the
geometric mean method
are more closer to the values as given
by the
pauling scale
the references
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