Hello everybody, I am miss Varsha K. Sail

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chemistry from Government college.

of Arts, Science and Commerce, Sanquelim. This module is

of the programme Bacholars Degree in

Science in the subject of chemistry.

for the semester five and

the paper code is CHC 106 and the

paper title is Inorganic Chemistry.

Section B.
The title of the unit

is Periodicity in elements.

The module name is Factors

affecting ionization energy

Part One. The model number is 7.

The outlines of this particular module.

So first we will be going

through the terms involved.

That is ionisation energy, effective

nuclear charge and then further

will be taking up the factors

affecting our ionization energy.

In this module,

we are covering up only two factors,

that is nuclear charge and

the shielding effect.

Now the learning outcomes

of this particular module.

Now, students will acquire knowledge

and understanding of different

factors affecting ionization energy.

They will also know the reasons for the

effective nuclear charge and the trend shown in

the periodic table along the group,

and along the period.

The students can apply this knowledge.

To predict or understand the

trend shown in the group or the

period in the periodic table.

They can understand the other chemical

properties related to ionization energy.

Thus,

they can also predict the trend

shown in the reactivity or chemical

properties of the elements

in the periodic table.
Now the first term which we are going to

go through is the ionization energy.

Ionization energy is the minimum

amount of energy required to remove

the most loosely bound electron

from an isolated gaseous atom.

Ionization Energy is also sometimes

referred as our ionization enthalpy

or ionization potential.
Now,

this ionization phenomena can be

represented as a reaction wherein

A is an atom in the gaseous state and

IE is the energy or

the potential which is applied to given atom A and

getting a cation in the gaseous

state by removing electrons,

which is again in the gaseous state.

Thus IE can be considered

as a measure of the ease with which

an atom can be changed into a cation.

This energy is

expressed into two different unit

of energy that is electron Volt or

kilojoule. Also kJ's are
Volt
related, as one Electron is
equal to 96.49 kilo joules per mole.

Now the energy required for subsequent

removal of electrons also known as

2nd Ionization Energy, 3rd

Ionization Energy or in general

successive Ionization energy.

Now these initial energy can be

determined from spectrochemical

techniques or by applying of a

by the amount of voltage required

for ionization.Another term which we

need to know before we go into

the factors is Effective Nuclear

Charge or $\mathbf{Z_{eff}}$

It is defined by the formula $\mathbf{Z_{eff} = Z - \sigma}$

where **Z** is atomic number of the atom,

hence is equal to the number of protons.

or the nuclear charge.

Sigma is this Slater constant or

screening constant. This

obvious tells about how much is the nuclear charge screened

from the outtermost electron.
Now the varition in inoization

energy follow the same pattern

as effective nuclear charge.

It increases across a period

and decreases down the group so all

the factors which are related with or

affecting the effective nuclear charge are

also going to affect the ionization energy,

Thus it is lowest for cesium and highest for florine.

Variation in ionization energy is related to

the attractive force the

electron experience in an atom.

That is how strongly the electron is

attracted or held by the nucleus.

Which is again directly proportional to

the net or the effective nuclear charge

as we have said earlier.

It is inversely proportional to

the square of distance between the

electron and the nucleus .

i.e how far is the electron from the

nucleus and ionization energy

is also related to electron electron

repulsion in an orbital, as a result

it also depend on the electronic configuration.

Factors affecting Ionization energy..

It is affected by the net nuclear

charge Z and the shielding

effect or the screening effect

of the inner orbitals.

Since it is affected by the distance

from the electron to the nucleus.

Ionization energy also depends on the size

of the atom or the nature of the orbital.

Also the nature of the orbital which

again decides how close or how far

away the electron is from the nucleus,

all these factors are interdependent or related.
Factors affecting a ionization energy

The nuclear charge of the atom.

The screening effect of the inner orbitals.

The size of the atom.

The nature of the orbital or the shape

of the orbital and electronic configuration.

Now in this module today we're

going to discuss about.

Net nuclear charge and the

shielding or the screening effect.

Now all these factors are related

or interrelated to each other.

The first I will take the first factor

that is Nuclear charge.

Is an attractive force between the

nucleus and the electron and is

directly proportional to the product

of nuclear or electronic charge.

Now, as the nuclear charge increases,

it seems that the size of the

atom goes on decreasing.

Also,

the columbic attraction between the

nucleus and valence electron increases.

That is,

the electrons are very strongly or

more strongly bound by the nucleus.

The energy required to pull out an electron

as a result Ionization energy increase when the electron

is strongly bound by the nucleus.

Hence Ionization energy increase

with increasing nuclear charge.

Now let's compare the ionization energy.

for the first and the second period and

see how does the nuclear charge

affects the ionization energy in

the first period.

That is, for hydrogen and helium.

The nuclear charge goes from one to two,

and the Ionization energy also

accordingly increases from 13.1 electron

Volt to 24.6 electron Volt. For the

second period starting from lithium,

barium, boron, carbon, nitrogen,

oxygen, fluorine and neon

the nuclear charge goes on

increasing.Nuclear charge is

same as the atomic number.

So as a nuclear charge,

or the atomic number goes on increasing.

The ionization energies are also

found to increasing in a

steady rate with a small difference

between nitrogen and oxygen,

which is because of another factor

which will be discussed further.

Now the shielding effect.

shielding effect is the shielding

of valence

electrons from the attractive force

of the nucleus by the inner electronic shell.

Greater the number of electrons in the inner shell.

greater is the screening effect

and lesser is a nuclear charge

felt by the valence electrons

or valence shell electron.

Thus screen of election or screening effect

goes on increasing as the number of inner

electron goes on increasing, lesser the nuclear attraction

felt by the valence electrons.

Schreening effect does depends

on the shape

of the radial electron density

of the different orbital.

Different orbitals have different shape
As a result the shielding

effect also changes,

so it is found to be highest in s orbital

followed by p and d and minimum in case of f orbital.

So the sheilding effect is highest

in S and on minimum in case of f orbital.

It is also found that the

electrons from the same subshell

do not screen each other.

That is,

electrons from the given

subshell will not scream each other,

but it will be screened

by the electrons in the inner

shell.

Thus it is found that our ionization energy
decreases as the number of

electrons in the inner shell or

the screening effect increases.

We will go through the first ionization

energy shown in some of the

groups as shielding effect increase.

As we go from hydrogen to cesium.

the number of shell goes on increasing.

In hydrogen we have only

one shell that is principal

Quantum number is 1.

In lithium we have got one inner shell.

Thus one S core is there and in sodium.

we have got a core of 1 S and 2 S.

So as we go down the number

of inner shells are going on,

increasing.So the nuclear

non nuclear charge felt by the

electron in the valence shell decrease.

As a result,

ionization energy also goes

on decreasing steady.

Similarly,

we can take one more group that is

the second group in the inner core.

as the number of electrons in

the inner of shell goes on increasing or as a number

of shell goes on increasing,

we can see that the ionization energy shows a

steady decrease in the ionization energy.

Now this trend is shown by all

the groups in the periodic table.

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Thank you.