

so good morning everybody today we will be starting on another chapter which is d and f block elements

so what are these elements particularly we should know and what are those positions and another name of these block elements are transition elements

so one important definition for this is transition

so these are transition elements and if we consider their position in the periodic table they run from group 3 to group 11 in the d block

so we all know that when we start from left hand side of the periodic table we find that group 1 and group 2 elements are there and at some point of time we find that group 3 and up to group 11 will come and these transition elements and if they are present from the occupancy in the d cell then we consider them as elements of d block

so we will just go up to group 11

so what about group 12

so if we ask somebody that what are the group 12 elements give some example of this group 12 elements we know immediately some can say that we have zinc cadmium and mercury

so that question immediately comes to us that whether we should include group 12 within these or not that will discuss later on

so what about these that the definition of transition what is the transition because of their position so in the periodic table they present in between s block and the p block element

so their position in the periodic table is important in the periodic table and it is between here we have the s block elements and on the right hand side we have the p block elements

so positioning of these elements therefore are important and this position is the transition position from s to p

so if these are s and these are p elements or p block elements

so we basically move or go for a transition from s to p via these elements so that is why these are known as transition elements and in terms of their properties will find that the properties are also transitional these properties are also transitional from s to p

so what is the transitional property that means these properties will be in between s block elements and the p block elements so they are first thing what we consider is their metallic properties

so what are the metallic properties of ace and

p block elements like sodium potassium magnesium and calcium we know that they are they are corresponding metallic in nature so when we move from them to these elements will find that they are also highly reactive metallic elements so if we move from these so which is also very much similar to that of your s block elements so they also form like s block elements as we slightly move from s to these they will also form typically ionic compounds and we know that the elements on the right hand side including the halogens they form the corresponding elements in the p block but these p block elements are largely covalent so they will get some property inherited from these p block elements also and in some cases in the latter part of the periodic table on the right hand side of these d block elements they will also form some covalent characters something related to these p block elements so as we know so s block property is also there so some amount of p block property like elements of p block as it gives typically or largely covalent compounds so some of these transition elements also will be responsible for giving typically all of these covalent character to this particular series so what we will find now that many of these properties so these two properties we mostly consider which are the physical properties so how we can consider that means physical properties of these elements and the chemical properties since we are considering their properties in relation to s block and pl block elements and what we are doing we are doing in these blocks that we are adding electrons not on the ultimate or the outermost cell but is the penultimate cell is responsible so we have the penultimate cell and the cell is also expanded when we know that s is filled and p is filled we get eight electrons but in this case the d level is failed d cell is failed so we move from 8 to 18 electron occupancy as a result many of these physical and chemical properties of these metals when you consider these as the metals so you they have the metallic property so metals of these group such as nickel such as copper so what are these metals so they will have some properties which are in common and they give rise to something which is typically the metallic property that means they are good conductors such as for both these two things that

means they are good conductors for electricity and heat then they can have metallic clusters they are also hard and strong because when you talk in terms of the metallurgical behavior of some of these metallons such as iron iron also comes into this category as the transition element of the d block element how we can improve that ah the property which is strong related to the metallic property and in some cases they are also ductile and another property which is very much related to their physical property is that they also form alloys alloys with other metals so these group of elements how we can therefore define so we just go for now the definition because the definition will consider all the species which will be there and will have if we have the d electron configuration so the d electron configuration whether that d electron configuration can have connection with this definition of these transition elements so that will see from here that this not only the d but also will be considering the f block elements in a similar fashion in the latter part of this chapter we will first find what are those f block elements so before that will just consider what are these d elements and what are the transition metal ions so by definition a transition metal is an element whose atom has partially filled d sub cell so the occupancy of these d sub cell is important and which can give rise to cations with an incomplete d sub cell so if it can give rise to some cations which have incompletely filled d sub cell then that particular metal or that particular element we consider as the d block element so you have the incompletely filled d orbitals so if we have the d cell or the d orbitals then what we will find that these are all incompletely filled and where these incompletely filled d orbitals or d cell in its ground state or in any one of its oxidation states which is therefore important that the ground state configuration should give us an importantly filled d cell or any of its oxidation states so when will consider their possibility of the oxidation states whether it has a one permanent or one very easily accessible oxidation state or it can have the different oxidation state whatever oxidation state you can have whether you have a in completely filled d cell or not that will typically define whether you are talking about the corresponding element which is a transition element such that the most common practice we know from early days of our schooling

that iron is there we know that n can have two plus or iron can have three plus
so one
we consider as a common name as the ferrous ion another is known as the ferric ion
so any of
its ground states basically that means whether it is present in the ferrous state or ferric state
we can have incompletely filled d level or the d cell or the d orbitals which will typically
define whether our this Fe^{2+} or Fe^{3+} both of them can be considered as the
corresponding transition element derive derived ions
so these are all transition ions or
transition element ions which can be derived from iron which is Fe^0
so in a similar way we
basically give for the definition for f block and in these two cases we just considered that
since the group will start now because you here we follow that the transition elements are following
from periodic table after calcium similarly here these are starting from lanthanum and actinium
so where the position of this lanthanum and the position of the actinium we should know and based
on that we basically consider that following that
so once the lanthanum we reach then the following electron configuration or the occupancy in the cell which is whether d or f is different and
this occupancy will consider as again some type of transition metals but this type the occupancy
is not d but it could be occupancy of the f cell
so occupancy for the f cell will basically give us something where we can have a group of elements or group of metal ions which will consider
as inner transition elements because after d we just get again not a ultimate cell but it
is a penultimate cell below this three d level is the inner transition metals or inner transition
metal ions
so initially if we just simply consider a part of the whole periodic table which belongs
to the d block elements and those d block elements are very important to understand that means
on the left hand side we have till calcium which has the atomic number of 20 and on the
right hand side we have the pre block elements
so in between we have in the period three
so we
have period one period two and period three after when we reach period 3 then only the possibility
of coming the corresponding d cell is there
so after calcium will be having the element first element will be scandium
so then we have the scandium titanium vanadium chromium manganese

iron cobalt nickel copper and zinc
so already we have defined this we are excluding these that
means zinc cadmium mercury from this list because these are group 12 elements
and we cannot
consider by that particular definition that means the incompletely filled d
cell which cannot
be applied to zinc in its ground state or zinc in its typically available or
most commonly
available oxidation state which is zinc 2 plus
so we will just get for period 4 which
is scandium to copper and what are those electronic configuration that will
follow that
these are occupying 3d levels
so these are also three d elements or 3d block elements starting
from scandium to copper similarly if we go the next period which is period 5
we get
strontium to zirconium niobium to ultimately to silver and cadmium and similarly
period 6 will
give you something where we have you see that 57 to 71 these are by
definition
these are the f block elements and after that d block elements then only
we'll
get the electron occupancy or electron filling to the d level which is hafnium
then tantalum then
tungsten to ultimately to gold
so these three we mostly are commonly encountered
so this particular
group that means from scandium to gold 79 we see that if we just be in the
group level
also the group similarity will also be there
so all these we considered as the triad
because these are not naturally occurring elements for the period seven only
some
synthetically prepared elements have been accumulated over there and day by
day we are just
filling up all these levels already we have filled up all these levels till
this 111 atomic number
but these three periods particularly period four period five and period six
are very important
to study these things and we know that one particular that means the clubbing
of all these
elements we put together that means the three d elements or 3d block elements
or d block
elements for scandium to copper we feel that how their properties are changing
as we move from
scandium to titanium to vanadium to nickel to copper similarly as we move from
this particular
period 4 to period 5 to period 6 what is changing we are just changing from 3d
to 4d to 5d elements
so down the group that means group four elements group five elements group six
elements and
group seven elements and group eight elements
so down the group how the properties of all
these groups can change because the ultimate electronic configuration will be

same such as that

of our nickel which is group 10 element and of 3d and of 4d it will be palladium and for 5d it will be platinum

so if we just consider something that means initially you have we do not know much

because we are not very much concerned about the corresponding chemistry of the metallic part

because its relation to the metallurgy and the metallic part or the alloy formation but if we

take out those two electrons that means two s electrons on the left hand side so s electrons

will be losing first

so we are remaining with the d electrons for its cationic form which is Ni^{2+}

so if we have Ni^{2+} from here similarly if we can have palladium 2 plus or if

we can platinum 2 plus in all these cases we see that the corresponding configuration in terms

of the occupancy in the d level will be 3d some number then 4d some number and then 5d sub

number similarly these properties that means from iron ruthenium and osmium but interesting thing

is that as we move down from iron to ruthenium to osmium and the size of the d orbitals are increasing enormously and the corresponding properties and the reactivity

patterns are also changing

so the next thing what will be seeing that how we can consider that what should be the electronic configuration of say scandium 21 or say platinum 78 we should have some

good idea how quickly we can write that it has the ultimate electronic configuration for scandium

scandium 0 is $4s^2 3d^1$ that means the first electron is entering in the level which is 3d and

that means that we have the unoccupied 3d level

so scandium by definition falls under that category of transition element

so titanium will be in the similar way that means the four $s^2 3d^2$

so what we are getting starting from group 3 to group 11 we are getting $d^1 d^2 d^3 d^4 d^5 d^6 d^7 d^8$ and d^9 system

so another way of classifying or placing all these in the periodic table is important such that we quickly consider

that in a particular oxidation state we can have electronic configuration which is also known

by its positioning in the corresponding group

so what we see that in the long form of the periodic table that means the color which will be telling us that the pink color will be telling us

that these are the transition metals

so scandium to corresponding gold

so this group this group

and the left hand side we have the corresponding s block elements and the right hand side we have the p block elements in this side and then the d block group which is inert also we know and as we move from here that means after lanthanum will be getting the corresponding occupancy like that 10 electrons in this particular group similarly we have 14 electrons in the f level so after lanthanum we get the series from here to here that means cerium to lutetium these are known as lanthanides similarly after actinium whatever element that means the 14 elements will be posing there due to the occupancy of the corresponding 5f level are known as correspondingly actinides

so these two groups will be coming over here before that we should finish our discussion in relation to the corresponding transition elements and mostly we always concerned about the particular part which is the first transition series because we know very much because these are mostly commonly available on the earth crust because as minerals and ores the corresponding abundances are more even they have present in the biological form in the biological system even in our body because iron we all know iron is present in our body also and a particular process like the process we call is a mineralization process that mineralization process is responsible for storing iron on the earth crust similarly other process which we can consider in a similar way that is the bio mineralization process and that bio mineralization process can be considered for storing iron in our body also for the synthesis of hemoglobin and myoglobin like things

so these elements are so important that we should know very much because they have different interesting properties related to the transition elements so the definition is that for d block element that we have partly filled d levels and for these two groups for lanthanides and actinides we have the partly filled f cells so if we just consider that what about the period four transition metals so will be just knowing now that what are those metals because we quickly will see that a particular type of metals what we will see that we can have this corresponding properties of these metals particularly how we can store and just now i am giving some examples that iron we know that iron in a metallic form we know that iron nail we know iron nail or iron seed we know so use of iron we all know very much similarly if we get something that the corresponding ions Fe^{2+} and Fe^{3+} and if i now say that any of them is also present in our blood as hemoglobin and myoglobin

so this particular thing will concern about the corresponding transition metal ions these are not metals so the corresponding property of these thing is that we have the corresponding property of these and how this iron will look like some of us have some good information about what the iron nail will look like iron seed will look like but what are these particular things will be in solution so this whether this will be soluble in water medium or any other medium and how they will also look like and similarly some of these elements can also be useful for the alloy formation so before going into that particular detail because iron what we know that iron is also present from the ore and minerals because this will all be present on the earth crust and if they are present as some oxide and in all of our redox classes then the previous classes we have identified that how we can recover iron elemental iron or the metallic iron from all these odds so this is a typical process which environment does for us the earth is doing for us and we are storing that particular one and when we recover so recovery process is typically the corresponding metallurgical process so this is the corresponding metallurgy we can have and that giving rise to the iron zero but how this iron basically iron will look like suppose if you are given with some iron powder because it has some important property for this iron as a dust particle type of thing so how this iron powder will look like so only some examples for this period four transition metal the first one is the typical example for scandium this is the metallic scandium so metallic scandium is there which is the corresponding group the element and if we put that on a petri dish so the metallic form of scandium will look like of this type similarly the titanium these are granules so if we have the corresponding ore from the earth crust so or for the titanium also we know that titanium dioxide TiO_2 is the typical ore for that so titanium dioxide is there and from there we just have to go for the corresponding reduction so the mechanism is there that how to get titanium from TiO_2 so in the metallic form if we produce that thing so in the corresponding granules are forming and the titanium so with

that particular thing will also give us the properties what we are just now discussed that

it has the luster it has a strength and all these

so the corresponding metallic properties for all these things will be there

so we get that for the corresponding vanadium also vanadium we just once we move to vanadium vanadium will also give us something where the color of these things are changing

so if i put something that means how nicely we look all these things that means from

the nature of all these things particularly the color of all these and the metallic cluster of all

these things can we can identify it immediately whether it is titanium this is titanium and that

is vanadium

so these all have different

so the particular nature of this particular units

that means the corresponding granules granules the nature of these granules these are not typical

powder because some other process we have to go for getting the corresponding powder similarly

chromium you see the chromium also look like a chromium powder

so this a chromium powder we can have

so this is a more powdery form this has less metallic cluster type of character

so it

is forming a typical powder type of thing then manganese manganese you all know the most typical

ah corresponding ore is the pyrolucyte which is manganese dioxide which is plenty in nature india

is also very much rich in having manganese dioxide or pyrolysis

so ah the mining process basically

gives us the mining for manganese we take out that particular ore and the industry the metallurgical

industry will give rise to the corresponding manganese

so if we consider that in some cases we

basically get that particular thing that where we can have that particular manganese typically in

our hand

so manganese will be for the particular manganese metallic state

so this metallic state

we can use sometime because most of these are as metal they can also react nicely with the acids

so the oxidation process because we all know now that they can liberate hydrogen from the acid so

direct reaction of all these can liberate hydrogen and the metal will go to the corresponding ions

like that iron when it reacts with hydrochloric acid iron powder

so this powder from the

petri dish what we can take

so if we react with hydrochloric acid the corresponding salt

what will be getting is the ferric chloride and hydrogen evolution can take

place so
the corresponding iron powder which can also be identified from the ores like hematite and magnetite cobalt is also very much similar to that of our vanadium case so it has also typical luster so is a typical globules having a sine appearance so cyan appearance on the surface of this will tell you that this is a covalent thing then nickel nickel is also of different nature that means when we go for the corresponding crystallization from a molten state because all these at high temperature we are getting as in the molten state and when we go down to room temperature they basically crystallize it out in a typical form so the metallic nickel will be separated out from in the particular fashion similarly this is copper so copper is also the last pieces which we'll get base already we are having four plus four plus eight plus nine elements we just reached there then we can have the i think we have the 3d 10 arrangement because the zinc granules jing powders and all these are very important to understand the positioning of this particular as required it is a transition element or not but the zinc will not be a transition element because in the elemental state or in the metallic state it has the corresponding electronic configuration of four s two three d ten so if we just take out those two electrons so the electrons will go from the forest level so the four s two electron will go to give you a four s zero electronic configuration leaving behind with three d ten electronic configuration so that 3d 10 electronic configuration will give you a field 3d level so zinc will not consider as a transition element so already we have discussed how we can jot down these physical properties so so as inferred by the name the transition metals are metals and thus conductors of electricity so whatever the species what we are just now have seen as the corresponding metals because in some of our next classes we will be discussing about the corresponding formation of the transition metals so if we have the corresponding metal which just now we have seen as the fe zero so it has all metallic property inherent to it but when we move from there to say f e 2 plus or f e 3 plus so this is the typical electron transfer process we all know and this is the oxidation process but whatever things will be producing in solution in water and these will be present in aqua solution these

two are in aqua solution
so these ions in solution
so these are we can consider them as transition metal ions
so whatever we have such as this
present in blood if they are present in blood in this particular two forms
that means either either
two or iron three or any other biological system
so those are we considered as the transition metal
ions
so we should always be very much particular that you have ions
so these are forming with the
corresponding ions not the corresponding metals so if we just consider that
this particular metals
and thus they have the good conductors of electricity
so the iron wires and all these
things we can have we know aluminum wires like that of we have iron wires
so that particular
then we have the good conductor of electricity we are using electrical wires
the copper wires and
they are highly dense
so there was a high density and high melting points and boiling points also
so if we consider that corresponding thing that what we get the corresponding
properties
is due to the progressive filling of the d cell but the filling of these
levels will
give you the corresponding metallic character of these
so the metals when we talk their
properties are due to the corresponding zero form that means that iron zero or
nickel zero and
they have the typical metallic bonding
so we will not consider all these things in this particular
class but we should have some little bit idea about what is called this
metallic bonding so
just now we have seen that in case of 4s element and the four p elements we
have the ionic bond
typical ionic bond and the typical covalent bond and in between we can have
for three d elements in
the metallic state they can have metallic bonding and in the metallic bonding
case also when
we will consider the typical bonding for the corresponding metal ions they are
also will find
some interesting thing for their participation in the corresponding bonding
when they
participate as the corresponding transition metallions but what about in the
free form that
means in the zero form in the metallic form they also participate for the
corresponding
delocalization of the d electrons and that is why they increase basically they
are cohesion due
to the large number of these electrons because we know that the capacity of
the electrons when it
is filling in zinc when it is filling completely in cadmium when it is filling
completely in
mercury they have 10 electrons altogether

so as we have discussed what is the typical indication that we are not getting as this particular one for the mercury which is a typically a different thing which is the field d level so all these not only mercury but starting from zinc which is 3d half filled so is 4s 2 3d 10 then cadmium 5s 2 4d 10 and then mercury 5s 2 6d 10 so these all will have lower melting points so the melting point is less boiling point is also less because they have full d sub shells and they don't participate much in delocalization and sharing of the electrons and they don't have very good dd bonding in relation to increase the corresponding metallic bonding so the conduction band they form but the corresponding dd bonding will not participate much in forming the corresponding character and as a result the highest one that means the mercury will have a very low melting point of minus 38.

83

degree centigrade or minus 37.

89 degree fahrenheit is a liquid at room temperature

so is basically is filling

so from that particular one that metallic property is not there but it has other properties though it is in liquid

so other metallic property will be there but it is not a transition metallic property we just expect from there

so the first 3d series we just now take out partly because we will be talking about their properties because what about these d block series

so this d block series will be there if we just simply talk in terms of the corresponding appearance of the corresponding oxidation states because just now we have seen from scandium to zinc how they look like now if we take out the corresponding reactivity pattern of these

so the one of the chemical reactivity physical reactivity we all know that how they form alloy what is their metallic cluster whether they are conductor all these but what about their corresponding ionization

so ionization is their corresponding reactivity pattern with the acid whether your acid is oxidizing or not that means the reaction with hydrochloric acid the reaction with oxidizing acids like nitric acid or sulfuric acid

so that will give rise immediately whether we are able to get the corresponding salt formation that we have seen the zinc the metallic zinc or the zinc rod in our previous redox chemistry classes we have seen that zinc rod

can lead to something where the evolution of hydrogen can take place and we can give rise to the corresponding metallic salt starting from zinc oxide or the zinc itself so this particular thing that now we can just separate it out quickly from group 3 to group 11 including the group 12 because we reach ultimately the $3d^{10}$ so the atomic number the elements and the configurations so configurations we always we can have some good idea so separating out of these cadmium to zinc and what about this particular possibility is also there that means we once we know that the zinc then copper then nickel which is a $3d^{10}$ element then we have the 4d then 5d so zinc copper and then nickel when we reach down to nickel then downwards we have the palladium and we have the platinum similarly when we iron iron is three d six four s two so if we go what we are just now seeing that if we know the configuration that means the positioning in the group the corresponding atomic number also so this we can find out is not that you have to memorize all these things but you should know that is atomic number once it is 26 by filling up the electrons from left to right from 21 to 30 where your position of the iron and its electronic configuration so if it is three d six four s two so this iron which is three d six and four s two so it is in the zero state so when it is losing two electron it is losing three electrons so straight away we will not consider the electron occupancy in this particular level so will state will write that is a $3d^6$ ion so ferrous is a $3d^6$ ion and this particular case what we will see that we have the most two common oxidation states so for iron here we will just simply write as we know that also for our blood in our body that either you have iron two plus or iron three plus or something which is in between or something related to its corresponding reduced form of the ferry so this Fe three piece and this so these are most common oxidation states which is very important that how facile they are that means the formation of these by simply reacting with say dilute hydrochloric acid cold and dilute hydrochloric acid which is aquas so the reactivity of the iron powder how we have seen that the what is iron powder so the activity of these iron powder will just lead to the evolution of hydrogen

so hydrogen evolution can take place and the corresponding ions will remain as

the chlorides are there

so we will have the corresponding thing as the ferrous chloride and if it is oxidizing because these the redox potential the redox coupled between these two are less than

the zero value for these two are also less which is point seven seven volt

so if oxygen is there

oxygen is much more oxidizing

so it is in air

so if we handle everything in aqueous solutions

already the water present for this aqua solution or the preparation of this hydrochloric acid so

O_2 is there

so this particular aqua solution so O_2 is the oxidizing one

so O_2 is oxidizing agent

so that will immediately oxidize this to Fe^{3+} plus

so what about this particular electronic

configuration

so electron configuration for Fe^{3+} we have to take out one electron from this

$3d^6$

so it will not be $3d^6$ it will be $3d^5$

so for these two that means we have $3d^6$ ion

and $3d^5$ ion which are most common oxidation states for 3-d levels

so since we are talking about

3-d

so if we just consider the periodic table

so in the periodic table we have iron

ruthenium and osmium

so which is $3d^4$ and $5d$ and these are having giving rise to

some electronic configurations

so if we consider that both of all of them are giving that means

the trivalent state $3d^5$ and state for iron trivalent state for ruthenium

and trivalent

state for osmium

so this is the electronic configuration which is $3d^5$ for iron

so iron

$3+$ will be $3d^5$

so without knowing much or without bothering much about what would be for ruthenium

so ruthenium will be ruthenium $3+$ this is iron $3+$

so iron $3+$ will be three

d^5

so ruthenium three plus will also be four d^5 similarly osmium can go for osmium

three plus which will be five d^5

so this is the advantage of knowing the periodicity of

the elements placing them in the periodic table and how quickly we can understand when we talk

about the chemistry of these because sometimes we can handle all these in solution having

some test tubes we can have some test tubes test one test tube two and test tube three

in one case we have ferric ion in solution in another case ruthenium in the trivalent state
in other case the osmium in the trivalent state
so the generalization of all these things are very important and we know that most of these cases we are removing the electrons from the d level that means this oxidation the first one electron loss one electron loss the first one electron loss for getting ferric ion from ferrous ion is the removal of the electron from the d level so this is much more facile but if we can have some arrangement and if we can have some stronger oxidizing agent so then we can find it out whether we will be able to take out the electrons from its corresponding positioning that means whether we can go beyond that means whether we can take out more number of electrons from these that means we can take out one more electron from this level giving three d four or three d three so those oxidation states we can get and those oxidation states will be termed as unusual oxidation states or uncommon one so uncommon oxidation states we can have that means beyond this so 2 and 3 can be there so we can have 4 plus we can have 5 plus or we can have 6 plus but all together what we can have all together we can have 8 number of electrons 2 in s level and 6 in d level so if we remove all these electrons from s level or s1 and d level or d cell will be getting something which is eight plus so whether we will be getting that particular one is important to discuss whether it is possible for iron and whether it is possible for all other elements so what we see that getting all these oxidation states that means plus two plus three plus four plus five and plus six so these elements these transition elements therefore occur in variable oxidation states so they basically occur in variable oxidation states so one or the other that means as we move that means the corresponding filling off of the d level from scandium to iron we are filling up stepwise one after another one electron two electron three electron four electron five electron and six electron similarly when we are talking in terms of the removal of electrons from that particular d level or d cell is the corresponding oxidation reaction so solution chemistry for all these metal ions is will be mostly dominated by the presence of the corresponding oxidation states and we should

have some good knowledge about the presence of all these oxidation states in our hand

so we

get this as the 3d elements or d block series in the third level similarly we get the next

one which is the second d block series which is from y to c d or arium to cadmium and again

like that of our electronic configuration uh the positioning of all these thing we see that in this

particular case also the progressive filling of the d cell is important and we have in some cases

we have the mostly from here that means d 1 to d 9 because this we just move for that if

we move this electron to the s level which will be 5 h2 and which will be 3d 4d9 we get the

progressive filling of the d cell

so we'll get these and since this particular one we are talking about

so this particular one since the size is increasing instead of writing as d6 s2 electronic configuration we can move because these are very close by energy wise these levels

are very close by the d level and the s level

so we can move this particular electron to this particular cell

so that is the configuration is now is 4d7 5s1

so that basically tells us

something that whether we can have that removal of single one electron from the s level

so removal

of that particular one electron will giving rise to a state where you can have ruthenium in

one plus state

so in a particular condition or in a situation that we will find afterwards that one particular type of compound we call as the organometallic compounds where we can

have some interaction of this metallic state in the zero that means the powders can react

with some of the species like that of our metallic state which can interact with that

particular thing that means simple carbon monoxide

so 3d container of this palladium is nickel

we all know that nickel can interact with carbon monoxide giving rise to tetra carbon in nickel 0.

so nickel will be 0 in that particular case is the organometallic compound and that

organometallic compound will have electronic configuration we just consider that electronic

configuration in terms of nickel zero similarly if we something that palladium zero in different

organic chemistry reactions the palladium zero the metallic state of palladium is important and

the corresponding electronic configuration if we push all these electrons to

the d level because
this has an extra stability the stabilization we all know that the half field
cell that is why this
particular cell we are writing instead of five s two four d four we write as
four d five five s one
so one electron will move from s level to d level
so it has some extra stability that means the
half field cell and the full field cell
so the palladium in that particular case that this the
palladium in the zero state will have a fulfilled state and that fulfilled d
level will have a
4 d 10 electronic configuration and is stable similarly the other one that
means the 5 d block
and the 5 d block will get the corresponding one from that lanthanum to
length or this
lanthanum this lanthanum is seventy one this not mutation is lengthening 1
a it would be 1 a to ah this gold
so there we are also having just simply
the same type of electronic configuration and same number of electron in the d
level and
the s level but thing is that now we can have the corresponding occupancy of
these levels and is
changing from one particular level to the other we are talking something
related to 3d level 4d level
and 5d level
so the corresponding occupancy of the corresponding period that means the ah
period
which we are talking about for 3d 4d and 5d
so in this particular case these are the 5d element so
the cationic state just now what we have discussed that osmium like iron
so after iron we have
ruthenium and then we have osmium
so osmium is the congener of the iron group
so in that particular
case we should not forget the group number similar fashion we should know the
atomic number
also nicely and the osmium and osmium is in plus two oxidation state like that
of our iron
will be five d six electronic configuration
so all these things and the particular type
of bonding in all these cases what we see is related to the corresponding
occupancy of all
these d levels and we'll just be able to consider the different thing that
means the 3d 4d and 5d
elements
so these 3d 4d and 5d elements
so we have
so if we just consider these 3d 4d and
5d elements in its elemental state that means m is in zero state
so physical properties
are also changing when we talk about the bond strength
so bond strength will also be changing
and this particular bond strength trend is there
so as we go for bigger and bigger d level or d

cell the bond strength strength will be changing and which is a different one which is a reverse

one for this

so this strain this trend is reverse to that normally we found for main group elements that means the s block and p block elements

so what we find for main group element is different for these transition elements

so we find that once we get that that means if we consider that what about tungsten then which is in the chromium group

so we have chromium molybdenum and tungsten

so chromium molybdenum and tungsten we have and in this particular case chromium we know that this has six unpaired electrons similarly molybdenum will also have six unpaired electron

so we have five d4 and six s two

so all these six electrons if we consider the corresponding property as its zero state that means tungsten in the metallic state

so the tungsten in the metallic state have the six electron and these six unpaired electron

they participate strongly in metallic bonding

so we have large number of electrons which are not possible to get for s level or the p level elements

so large number of electrons are available for these

so as a result they can have also very high electronegativity

so tungsten will

have therefore have very high electronegativity and this particular information is also important

from our early school days we know that they can be utilized

so they have a very high melting point and high boiling point

so tungsten the metallic tungsten will have very high melting and high boiling point and as a result they can be utilized for making the bulb filament

so the

bulb filaments for incandescent lamps we use tungsten as the corresponding material for the making of these bulb filaments

so we can have these that means we just corresponding unpaired electrons

so we basically change the corresponding a melting point

so we just can see also what

about the corresponding melting point trends also

so as we move from scandium to titanium to

ultimately to zinc

so we find that the typical melting point in degree centigrade will also be changing and which are above 100

so mostly it is above 1000

so not sorry about thousands

so above

1000 degree centigrade and in some cases they can go up to 3000 degree centigrade

so one value

is 1539 degree centigrade for scandium

so it is increasing for titanium it is increasing for vanadium as well as chromium but in case of zinc it is less since those number of electrons

which are there but is in the field cell it is not available for that kind of metallic bonding

so minimum will be finding over here where the levels are filled

so the melting point minima

will be finding over here and melting point maxima will be here for the transition metal ion so

thus we see that number of electrons in the elemental state will not forget that all are in

the elemental state that means the scandium as the metallic scandium titanium as the metallic

scandium they have the high melting point high boiling point and some of these uses related to

the metallic state

so the next day will be just considering how we get for the corresponding electron transfer reaction for the oxidation that means the availability of the different

oxidation steps ok thank you very much you