good morning everybody welcome to this
fifth class of d block and f block elements   and today we will just finish the d block elements
and the next is what we will be discussing   about the d block elements are the colors which is a very important aspects for any d block element and what we should all know and
we should have some very good idea   compared to the other s and p block elements   and in all these cases starting from the very well
known example what we know that what should be the   color of the sodium chloride powder or the
potassium chloride powder in the solid state
so when they are solid we should have some good
idea about these and we all know that they are   white in color and if i now ask why they
are white
so it has no relationship with   the corresponding coloration and if they are colored and if they are differently color we   know in the visible range we have
so many color
combinations and
so many options we can have
so in this particular case the absorption in a
particular range is taking place
so if we have the   absorption in the corresponding energy the
electronic energy what we will see the mostly   which changes the corresponding electronic levels
of the metal ions are the anions and all
so if the   absorption is taking place in the corresponding uv
range and the corresponding color what we see that   is white in color
so there is no absorption in the
visible range
so what we just see that the colors   of these compounds whether they are good metal
salts or that ions in solution and they should   be colored in the visible region because our
eyes can detect only those colors where we can   have some absorption in the visible range
so most
of these compounds whether we are getting some ionic compounds what we will see afterwards for
the different metal complexes also and some of   them are the corresponding covalent compounds so
both ionic and covalent compounds what we can have
so these can also give rise to the formation of
several inorganic materials or inorganic oxide   based sulphide based like these because
all the minerals and ores what we know   they are the good materials to handle
so if we get those materials in our hand   and if the light is passed to that
material what we see that some part of the electromagnetic
radiation will be absorbed
so what particular   wavelengths we are going by
so material can absorb
some parts say blue region or the green region or   the red region of the spectrum electronic spectrum
for the visible range

so they will be deprived of those wavelengths which are absorbed
so some part of the electromagnetic
radiation is absorbed
so we will see some other color that means we will see the
corresponding complementary color for the materials
so this particular absorption not
only the visible region but visible plus u v range if the absorption is taking
place in
the visible and the uv range
so what we see that the corresponding absorption and the property will
also see that the absorption energy will be there
so absorption of a corresponding energy can be
there and if this absorption is taking place in this particular range
so which are due to the
changes in the corresponding electronic energy
so we will be focusing our attention
on the changes in the electronic energy not due to that vibration the bond
vibration or the rotation of the molecule
so this we are not talking about
so if there
is a change in the electronic energy and this particular thing which is a
complementary to
that absorb some has absorbed
so what we will get will get the corresponding complementary
color to that what is absorbed
so we get the complementary color
so we should know that
what particular wavelength is getting absorbed and what should be the
corresponding
complementary color in this regard when there is a change in the
corresponding electronic energy
so we call them as electronic spectra
so in these
d block elements we all know that there are five d orbitals and those five d
orbitals we all know
the different five d orbitals and when they are in the free iron state that
means the gaseous state
and all we call they are having the same energy that means they are degenerate
so if they are
having the identical energy in the gaseous state but what is forming there if
we go for that
particular species say ni two plus or iron three plus in solution
so mostly we will be looking at
the colors of two different types that colors for the salts and the colors for
the corresponding
ions if we take those ions in solution and in some cases also
so some cases also
we see that if we have a ferric chloride salt we know that is a typical salt
what we get
in the solid state
so that can be also hydrated so the salt this particular salt will have some
color
so what is happening in the solid state structure is important
so salt will have some structure

so in the solid state structure we have fe3 plus which is surrounded by the different number
of corresponding spheres of chloride ions
so when chloride ions are surrounding fe 3
plus we should also have some idea that what will be the condition of these five degenerate
d orbitals or the five degenerate d levels
so in this particular case these are the corresponding
ions
so we have in the solid state we have the ions which are available to surround the central
metal ion in the corresponding crystal lattice
so we have the crystal lattice and the lattice is
surrounding all these
so if there is some effect and there is something which can part of the d
orbitals in terms of the corresponding energy and the geometry of this particular solid state
structure will see that these will not be d orbitals no longer they are degenerate no
longer
so these five orbitals may not be degenerate
so they can be separated into
two groups say the two groups are one in one particular group it is two orbital and another
it is three orbitals
so that will again discuss in detail when we will study the coordination compounds
so this solid state thing will be that that no these d orbitals will not be degenerate
in nature and if we get these two levels there can be some transition electronic transition
like this in the electronic spectra if we have some unpaired electron in these d orbitals
we know the very basic definition of these d elements or the d block elements or the
transition elements in the first series say they are having multiple number of d electrons
in the different d level
so they are having the gel configuration electronic configuration is
3 d n
so these different number of electrons if they are occupying the ground state so
energy will be absorbed in this particular range in the visible or the u v range and
the electron can be promoted from the ground state to the excited state because already we
have created due to this particular splitting of d orbitals we have created two levels so
the energetic transition can take place which is equivalent to we all know that is delta e the
separation which is equal to h nu
so to how to correlate this new this new you all know the
nu can be correlated with that of our lambda
so depending upon the energy separation between

these two levels we get the corresponding new value the frequency for the transition as well
as the lambda value for that and what we see that since the absorption is taking place
so this
absorption is there
so we get the corresponding complementary colors from the
so ah with the
spectrum the complete spectrum for the uv to visible region some part is getting absorbed and
we get the corresponding complementary color so what about these in solution
so in solution
also when we dissolve a particular metal salt say in water
so if these are all water molecules
surrounding the ferric ion center in solution
so what we see there that like that of
our anion surrounding the central metal ion the water molecules we all know that
these water molecules since iron is in the tripositive charge
so water molecules all we
know that it has two lone pair of electrons for this structure of hoh
so these lone pair of
electrons will be donated and they are having some charge separation which is delta minus and delta
minus with that delta plus and delta plus
so start separation can take place and we generate some
dipole
so dipole will be all directed towards the central metal ion center and as a result again
like that of our interaction what we have seen in the solid state that again the generation of
the d orbitals will be lifted that means they are no longer degenerate and there will be
two groups of d orbitals of different energy
so we have we just what we have seen
that we have the two groups basically and between these two groups there will be that
particular transition
so this interaction is typically one such thing where the absorption
can take place
so this particular color when how many of them that means how many of these water molecules are there we all know that when the ferric chloride or any other ferric salt is
dissolved in water the species what is forming in water is feoh2 whole six three plus
so six of
them surrounding in a regular geometry which is octahedral in nature
so that octahedral structure
surrounding this fe3 plus in a specific way it can split these d orbitals
so this particular color
that means the color between these two levels
so the color between these two levels
also depends on the number this number is important that means these are six depends

on the number and also the shape of the complex
so the very basic or very simple thing
what we can understand from there is that if we know that when we dissolve a particular metal salt
so we have a metal ion salt ok
so there are these things
so you have
metal ion and the salt is for the corresponding anion suppose you have the nickel chloride
you have the ferric chloride and
so on so this particular metal salt
so it is in the that
particular salt we all know that most of them can be separated in the solid state so
the solid state color we always can have and the nature of the corresponding groups
which is surrounding this particular species
so that if you change for the corresponding hexa
a conical species which is again octahedral like that of our ferric one
so again six water
molecules will surrounding the nickel center and we all know the corresponding color which is
a very characteristic one whenever we have nickel and if it is surrounded by water like ligand so
these are good ligands
so six ligands are there
so we get something which is the very basic
foundation of the coordination compounds which is the corresponding ml six cation since
water molecules are all neutral
so the overall charge on the complex is ml six two plus but
what should be the color already we defined that the depending upon the nature of this ligand
and the number of this ligand and the geometry and shape of the complex you have a particular
color
so if we move from this ligand to some other ligands suppose this is l one if we move
l one to l two to l three what happens therefore that if this is there and we all know that if
these are octahedral
so there is some separation which is our delta e
so depending upon the nature
of this ligand
so therefore the color depends on the nature number and the shape of these ligands
so this delta e basically for this first ligand this will be delta e one for the second definitely
it will change whether it can go up or it can go down the color will change accordingly
but you have a separation of delta e two similarly if we go for the third ligand
you can have a separation of delta e three
so always we should know the trend basically

depending upon this energy gap from delta e 1 to delta e 2 to delta e 3 we can have the
corresponding variation in all these colors as we move from one ligand to the other to
the third one
so that this can be correlated definitely to the corresponding lambda values
so this will give you the lambda 1 this will give you the lambda 2 and this will
also give you the lambda 3 and obviously the color will change
so the solution colors will be changing
so what we see here is that how we go for the development of colored ions
so if we have the ions when ions are there in solution
so they will give rise to some coloration which
is different from that of your s block and p block elements that means if we have sodium chloride in
solution we cannot see any color but if you have the corresponding nickel chloride or copper
chloride in solution we have the corresponding color
so as we define the transition metal ion
compounds or the complexes are often colored because of transition between the d orbitals of
different energies
so some of them will be in the lower energy which are in the ground state and
some will be in the excited state which are of the first excited level or the in the excited level so
when an electron moves from the lower d level to the higher d level the energy of excitation
corresponding to the frequency of the light absorbed and as a result if we mu for all these
metal ions say tetravalent vanadium to copper we can see very characteristic color
it is taken again from your cbse book
so if we clearly see this change in the color and
once you very much accustomed with the change of this color you always suspect because there
is a difference in these two blue colors also there is a difference between these two green
colors also then the this pink and the light pink color and the yellow coloration
so depending upon
these seven colors you can immediately say which one having ni two plus
so as we have discussed
right now that if you have a nickel salt nickel chloride or nickel sulphate or nickel nitrate
in your hand and you dissolve it in water only due to the presence of different amount of anions
some changes little bit changes of these species this color will take place otherwise you have the
typical ni 2 plus color which is very much that of this one
so this is one way of identifying a

nickel salt in solution
so any unknown solution if it has a color what you can do is a very simple analytical experiment always you do you use some reagent
so this particular reagent
can react with this nickel because if this solution which is a little bit concentrated
definitely it is in the decimal concentration but if you go down this concentration
the color will be fading away and we get more and more faint color and sometimes it is very
difficult by your own eyes that your naked eyes we take the help of the corresponding colorimeter or spectrophotometer to identify that particular color but if we get that we will again discuss in detail when we study the coordination compounds
that if this is there that means the nickel center is surrounded by six water molecules which give
rise to a particular coloration to the medium now if we get give you some characteristic species
or other species like say ammonia
so ammonia will change this color and sometimes we can use
something which is also known as some reagent which can separate out this nickel as some
insoluble material or insoluble compound which is not soluble in water which is separating out
so that is another way of identifying this nickel by using that particular reagent which can
give you the precipitate like identification of chloride by adding a solution of silver nitrate
which gives you the precipitation of silver chloride similarly if we add here we all know
that the dmg dimethylglyoxin in ammoniacal medium if it is added to this nickel salt this will give
rise to the corresponding precipitation of a very well defined colored species which is insoluble in
water okay
so when this particular part that means what we are discussing just now when a particular
part is absorbed we always see a complementary color of that light what is being absorbed
so this
is corresponding very well known colored wheel we all know that if we have a typical solution that
is a solution is red blue and yellow and also we should know that is when we just simply draw ah
the color of the different paints or the colors but what you see that the solution color why
the paint is colored to you ah why the paint is yellow it has some characteristic color that
will again discuss some inorganic compound which has a very bright yellow color and if there
is some other compound if it may not be an organic compound it can be organic dye also
similarly some is also blue which is also may not be inorganic that means metal ions are not

their only organic part is also colored
so this is the wheel which tells you the corresponding
mixing procedure that we know that in vivjor we have seven colors but we have three basic colors
and the mixing of those colors we ultimately get when all of them are mixed together we get white
color but in if these three are mixing we get a black coloration with some other colors which
are derived from the mixing of direct these all these solid colors
so if we get three plus
three six colors in that way then because we have electromagnetic spectrum starting from
your violet to red which is your bib gr
so vivjor as we move
so this particular coloration it
is basically some amount of practice and not a memorization but you can have some practice that
ok we have the red blue and the green thing also and we are also the corresponding magenta yellow
and cyan color and how the color is moving from say as we move from violet range to the red range
in the electromagnetic spectrum we know that the corresponding rainbow that the colour how it is
spreading how it is nicely spreading when the prism is given to the white light it is basically
spreading but sometimes we are unable to detect a particular ah light by knowing these two colors
but in between we should have some good idea which is light blue and which is towards red which
is violet in color similarly which is rose red and all these and some is also if we mix little
bit of blue to that we get the cyan and ah where the mixing the proper mixing proportionate is
different that means the mixing of cyan and green will give you something which is also a different
color then color is fading away
so what i was telling you just now that if you have a very good
or a different type of green coloration for the nickel two plus in solution and when you dilute
it out it gives you something some dilute solution or the dilute or very faint green coloration
and ultimately it goes for the corresponding coloration and which is very difficult to detect
sometime as the origin is typically a green in color
so as some part is absorbing
so wavelength
range if you just simply use the ah corresponding color emitter or spectrophotometer what we see
that a particular range of wavelength can be divided they are not of equi separation is not of
equal size
so it is four hundred to four hundred twenty force is only twenty four nanometer in
length but this one is the smallest one you see that the 570 to 585 only 15

nanometer
long
so when violet is absorbed we see the color of the solution is like this
which is green
is green yellow or the greenish yellow in color similarly when some part is
absorbing
so when
all these
so this has been categorized like violet blue green yellow orange red and
these
are the corresponding complementary colors and as we move there we get the
corresponding color
due to the complementary color
so when we see some solution we always see what particular
color is absorbing because quantitatively we will be just recording if you
want to record the
corresponding absorption in these values only that means when a solution is
typically blue
such as copper or nickel in presence of ammonia definitely your lambda max the
wavelength
which is giving you the corresponding maximum range of this particular
wavelength
absorption
so in the electronic spectrum the spectrum what we get that is in the range
of
570 to 585 or sometimes 560 nanometer only
so the blue solution will definitely give an
absorption in this particular range similarly yellow will give you in this
particular range
and the blue and cyan blue will also give you these colors in a different one
so if we just
now go back what we are just discussing that what is you are having these
compounds where
the colors of the different salts what we are just discussing about the
corresponding
salts like nickel chloride or iron chloride
so some idea we must have about the corresponding
color
so here we have taken say 5 plus 5 8 salt
so these are not solution color what your
book is discussing in your book it is there but whether we are able to
identify those
solutions from these swords
so when you dissolve these salts and these salts we know
that if it is nickel sulphate nickel is in bivalent state similarly if it is
copper copper
is in plus two state and if it is iron iron is in plus three state or plus two
state
so depending
upon the oxidation state you have different number of unpaired electrons and
the colors will all
be different there
so among these six colored species we have two three very well known or very
well defined white color or the colorless species or the white powder

basically when you dissolve it
in water like sodium chloride it will not impart any color to the solution and it has a very faint
coloration
so from left to right as we move for the 3d elements from left to right from scandium
this is definitely a scandium 3 oxide
so which is sc203
so scandium oxide is definitely a white
powdered compound if we try to get that compound also during some identification or isolation
process that scandium oxide what is ah going out from the medium as precipitating out from the
medium like zinc oxide would be white in color similarly the titanium
so titanium is in plus 4
oxidation state which is tio2 we all know is a very useful ingredient for white paint
so titanium
oxide is ah typically white in color but vanadium is vanadium four plus
so vanadium is in four plus
oxidation state
so which is basically v o two plus
so v o two plus is there and which has a typical
coloration
so banana sulfate when you dissolve this gives rise to a particular type of coloration
so this also gives us some idea that what is vanadine sulphate your vanadine sulphate is voso4
so the species what we get is the v bound to o having a charge of two plus
so we get basically
v o two plus species which is the vanadil ion
so vanadial ion will have is has a particular
color we know if we just dissolve if we know the salt color also similarly the other species
also we can find out that corresponding species is there
so this piece is like v o two plus which
is vanadium five species and then v o four three minus which is also another vanadium five species
and which are having a very pale yellow coloration
so knowing this ionic coloration for these ions
we can find out which one having this particular vanadyl ion or the corresponding vo2 plus species
is present
so this particular one
so next one is definitely a chromium salt but the chromium of
different salt which is sodium chromate in a two cro4 and which we all know is a very bright yellow
it has been used as a paint also
so it can be used as a yellow pen to us
so sodium and chromium you
see that the chromium in the highest possible oxidation state that means chromium in six plus
so you do not have any electron in the chromium d orbitals which is the d zero system but still due

to charge transfer transition it is highly colored
so oxide ions is basically responsible for charge
transfer to the chromium center which is devoid of any d electron then
manganese two chloride having
unpaired electrons still there in the d level but which is faint pink in color
so solution color
is very friendly colored
so sometimes is very difficult to identify through our eyes then this
particular salt is not a typical salt of iron that means ferrous chloride or
ferric chloride but
we should also know that this is ferric one so it is potassium ferric cyanide
so presence of
other anions in the solid state as well as in solution can change the
corresponding color of the
species like that of our potassium permanganate so potassium permanganate is
changing its color due
to the corresponding charge transfer condition
so the promotion of this from the oxide level to
the manganese level giving this color similarly here also the ferric ion the
electrons are there
then the cyanides are there
so it has a different color then cobalt two chloride is a very standard
salt cobalt in cocl two hexahydrate dot six h two ah which has a nickel two is
also there nickel
two nitrate is green in color then copper two sulfate we all know the copper
two pentas hydrate
is a very characteristic color we all know this
so as we move as we go here copper 2
plus is a 3d 9 system
so the next one will definitely will going back to like that
of colorless species which is the zinc salt
so the zinc two sulfate hepta hydrate z and so
four seven h2o is also colorless
so this gives us some idea what are the salts and how these salts
we can identify
so let us take some example of these that the complex ion species what is
forming
in the solution and which is important for all these cases apart from the
corresponding aqueous
thing that means the nickel is in the solid state
so which is ah green and a characteristic green
type of color
so when you dissolve it in water medium it gives you the corresponding
equated
complex that means the hexa aqua nickel 2 plus
so this hexagon nickel 2 plus is green in color
as we all know compared to your copper which is blue compared to our cobalt 2
plus which is
pink in color
so when we dissolve it we see due to the presence of the different ligands
we have told you that if you have the different ligands present over there you
see
so much change
in the coloration due to the presence of this nickel only

so the identification of nickel by
all four ligands what i am just discussing to   you l one l two l three and l four or if this is
l one then l two and l three and this is l four
so these basically give you all these colors
and if you are able to these colors simply in   the test tube you should be able to detect that
whether you have the nickel in your hand
so this   the last one basically when you dissolve any
nickel salts a nickel chloride you will get the   hexagonical species and when you just simply
add ammonia to that all the water molecules   one after another can be replaced by
ammonia molecules
so the nickel environment   is changing from nio6 coordination
sphere to a nin6 coordination sphere   and the further change in all these thing that
means the from the ammonia to ethylenediamine   en is nothing but the ethylenediamine which is
the typical organic ligand by dented chelating   ligand that i will discuss in detail afterwards
but if we just simply go back to here which is   having a different geometry and that's why the
color is also different
so shape is different   color is different and the corresponding anion
here now like that of our solid state structure   where we are discussing the nickel chloride in the
solid state also surrounded by chloride ions but   here also in the solution when you put more
and more chloride concentration you can add   simply dilute hydrochloric acid one is to one
hydrochloric acid or simply any other saturated   solution of sodium chloride or potassium chloride
it gives you that tetrachloronicel at salt   that gives us some idea how the corresponding
k 2 n i c l 4 is forming in solution and what   should be its color
so you see the color is
completely different to that of your corresponding   aqua species
so depending upon this corresponding
color what we have seen just now that the yellow   color yellow color we have seen that is the
chromium compound of particular type
so if we   take the example of two of these compounds and we
do not know what are these but you if you clear   carefully watch or carefully notice the
corresponding color of these powder compound   that one is very bright yellow and another
is very crystalline also the red crystalline   thing like our sugar
so this is a very good red
crystalline compound but these are of some says   the grain sizes are there
so the both of them are
of chromium compound
so these chromium compounds   this is chromate and this is dichromate
so there

is again a change that will see afterwards also but these two are very useful species when we will talk about the chromates and dichromates for the corresponding formation of these chromates and dichromates from some minerals sacramite ore because from the chromite ore we can separate out these two species for the corresponding preparation of the corresponding sodium dichromate which is na2cro4 and the potassium dichromate which is k2cr2o7 but this particular color which we can see because this lead chromate is if it is sodium chromate this is sodium chromate we can prepare lead chromate also by addition of lead nitrate or lead chloride to a solution of the sodium chromate we get the corresponding precipitation of this lead chromate but this is a particular mineral which is known as cochite so crochet is the mineral ore which is found in south america so in the south america in the desert part which basically get that thing but if we in the laboratory if we make the late chromate which is differently coloured because this can be used as a very good ah paint which is known as chrome yellow so industrially it is well known so chrome yellow paint we paint the automobiles we paint the school buses like this with this yellow color because yellow color is very much visible from a distance but this particular lead chromate which occurred naturally having a spectacular red long crystals you see this color is completely different compared to our lead chromate what we can make in the laboratory why this is so because this is typical crystals and these are ah from the earth and the corresponding hydrothermal vein it is forming and the depending upon the nature of the corresponding crystal type so crystal type is basically changing its color so the dense packing of this crystal and the nature of the crystal also the crystal system will give you a completely different color from this yellow to red and this is a very well known thing and is a very good colored thing so if we can naturally get this particular compound and if we grind it like that of our dichromate we can use this also as a red pigment and this yellow color can be utilized for the painting the corresponding ah chromiolo painting to the school buses okay so what we see therefore that that this will go later on so this f block before going to the a block elements what we see that this chromate and dichromate thing what we are discussing right now that how you get the dichromate that means it has a chromium c r two species is

there two from a chromate which is a chromium one
so one chromium
only
so which is all we know that c r o four   two minus is the chromation and if we go to
dichromate
so chromate to dichromate we can move
so c i have to o seven two minus
so is a dimeric product of this   where you have a chromium chromium thing and there is no such chromium chromium bond but   you can have a chromium oxygen chromium
link over there and interestingly this   is related to the ore which is also having
the name of chromium
so which is chromite
so chromite ore can be handled which
is a ore containing fe iron is there   cr2 4 it has a characteristic color also and
we can use this particular ore and if some   unknown practical class or some analytical
chemistry class which we find are that how   to identify that whether you have chromium
in the chromium that chromite ore that will   see that some fusion reactions that how you
can fuse it that means if you go for some fusion reaction
so fusion reaction is
that heating this with some other powder   such that you get a melt
so once the
melt is available
so melt if you go   for the corresponding fusion with some sodium or
potassium salt we all know that this particular   sodium or potassium salts are very useful for the
solubility in the water
so if the melt is forming   which is soluble in water that means something we
are using for this particular fusion and sometimes   during the fusion we
require that this the powder
so chromate ore is taking in the powder form   and is mixed nicely with another powder so
another powder which when also giving the   male
so it gives us some pores
so some gaseous
product should come out
so some carbonate salt   is very simple is that the sodium carbonate
you use
so sodium carbonate you use with more   oxygen from air
so we pass air
or you can do in the air also   and this particular fusion is taking
place at a very high temperature say   above thousand degree centigrade in the range of
thousand to thirteen hundred degree centigrade
so in the laboratory also we can take a mica
foil also and mica foil if you just sandwich   between two micro foil this mixture of these
that means the chromito the sodium carbonate   and air is always present in ah

the environment
if you fuse it with that that on the bunsen burner we get the melt
so melt is forming
so once we heat
that particular one
so this one will be converting to something which is the present in the mild that
melt what is there is that we take out this as the cro4 two minus and in presence of the sodium
also and during this fusion what is going out as the gaseous product is always definitely we are
heating a carbonate salt
so carbon dioxide will go out and it makes some holes over that particular melt
so melt will be a very fluffy material
so this basically give rise to the formation
of n a two c r o four chromate is forming along with some amount of that fe2o3
so iron will
not give you some kind of period there only that ferric oxide is forming with the elimination of
this carb carbon dioxide
so if we use the mole ratio of four with that of our eight of n a two
c o three and seven of o two we get eight of this twice of this and eight of co2 will go out
so this melt is there
so melt is forming at a higher temperature
so when we just simply allow
it to reach the room temperature when we allow it to reach to the room temperature the solid what we
get after cooling
so what we do is the cooling and we get a solid product
so solid product what we
will have we have both
so this is the thing that where we can separate the solid only thing that
if you pour some water
so water we add and since it is a sodium salt this will be highly soluble
in water but this is oxide which is insoluble in water
so that gives rise to the separation process
that means one will be soluble and another will be not soluble
so fe2o3 will be there as residue
so this fe2o3 will be there as residue and na2cro4 is there
so na2s cro4
will be there in the filtrate now how to get this one because ultimately we also can be able to make this
so once we make sodium chromate we just now i told you that you
add pb2 plus to get chromiolo the lead chromate the chrome yellow is forming which can be used
for painting
so once you is this
so the simple acidification because most of these oxides because
this is also a typical oxide which is coming from this your oxide mineral like this chromite
so most of these thing in presence of acid h plus
so once you get this the corresponding acid

so sulfuric acid we basically try
so once you add   sulfuric acid this can be giving rise to something
that the sodium will be taken out as the sodium   sulphate from there and this will be giving out
initially the chromic acid and that chromic acid   will be condensed together that means when we
have some of these because this chromate is cr   we all know that chromate is having this this
and this and when this particular one is getting   protonated by h plus of this addition
so when
you add this h plus this will be protonated so   two such these pieces that means one o h on the
left and another o h pieces containing species   ah on the right
so what we get there
so two
such species can condense together
so if we   get from there which is h two c r o four which
is the chromic acid which can also be prepared   we all know that the chromium trioxide is the
well known oxide which is the acidic oxide   when it dissolve with water we get h2 cro4
which is again the chromic acid which has a   very good cleaning property of organic material
or the organic greases
so glasswares which is   stick with some very sticky organic material
can be cleaned by this because the chromium in   higher oxidation state can be utilized
for oxidizing those organic compounds
so this can also be used in the leather industry
for tanning and all this chromium has some useful   use for all these purposes
so now you see that if
you get that chromium attached to o h on the left   and chromium attached to h on the right and if we
consider two of them
so similarly this is there   and this is another o and this is o and this
is o and this is o and this is o
so what   happens this next type
so next step is is that
we can have this that means we get the removal of   water molecules
so this water molecule can be
removed from there as h2o and we are ending   with this link that means chromium oxygen chromium
link is established in the dichromate species   but is that you cannot have you have the
possibility for this also but it is not that only   one end of this chromium and another end
of this chromium
so this is tetrahedraline   structure this is also a tetrahedral structure
these two are coming to each other and they fuse   together
so fusion can take place only through
these two species only that means this one so   this other three parts are away from this
link that's why this is forming but chromium   o chromium and chromium o

chromium is not forming
so this definitely is not forming over there because the other end is not close to
each other for this condensation reaction
so once we get there that means this is forming
over there as sodium ah corresponding one as the sulfuric acid is added
so you have the sodium
chromate
so n a two c r two o seven is forming and this sulfate is going as the sodium sulphate
n a two s o four and both of them are in solution
so in solution what we get that the large number
of water molecules are there also forming from there and we go from there the corresponding
evaporation
so evaporation technique from there basically give rise to the corresponding
crystals of the sodium as dihydrate so sodium dichromate can be separated out from here
as the dihydrate because we know that during this particular process you have this ah the
corresponding solubility difference
so first the sodium crystal which are having sodium sulphate
crystals which are higher solubility that can be ah in solution only the sodium chromate can be
separated out this will be in solution because it has a higher solubility
so the solubility
difference will help us for the separation of sodium sulphate from sodium dichromate
so this we
basically use for different purposes because this dichromate is very useful for making potassium
dichromate what we use
so n a two c r two o seven what we get from the chromite ore we can
make from there the corresponding potassium salt k two c r two o seven by the addition
of these are basically red crystals
so this particular one by the
addition of hot and concentrated hot and concentrated solution
of potassium chloride then again this is forming and the potassium chloride is
giving you the potassium to get the corresponding salt as well as some amount of sodium chloride
will be forming over there then the separation again we follow this particular one that what
are the thing that means what is crystallized from there
so depending upon the solubility
differences between this potassium dichromate and sodium dichromate
so sodium chloride will first
crystallize and then the potassium dichromate which is formed by using that particular technique
the separation we basically go for fractional crystallization
so we are going in fractionation the corresponding
crystallization process for these two
so this is one example what we know that these

are the corresponding hexavalent chromium present in this chromate and dichromate which is very much
similar to that of our hexavalent sulphur behavior
so hexavalent chromium can be
very much useful for using this as the corresponding primary standard in volumetric analysis
so it can be a primary standard solution in volumetric analysis what we can do in acid medium
so we
have little bit strong acidic condition
so this acidic condition is maintained such that
we are handling something which is only cr2o7 that means the dichromate ion because the formation
of this dichromate to chromium three plus will give us some idea about the corresponding
reduction process which is for these two
so is two
so hexavalent to the trivalent
so is a six
electron transfer process and which is only achieved having some corresponding e zero value of
one point three three volt which is only achieved in acidic medium
so that acidic medium is very
much useful and we can get the corresponding one
so 1.
33 volt for this volumetric analysis to
get back to the chromium as chromium 3 plus and in presence of say this on the left hand
side we put for the balance purpose fourteen h plus and giving rise to the six electron
transfer forming seven h2o definitely so seven of these dichromate things are going out
so these are forming your water molecules so this has a very good primary standard solution so
we can use it and because it is stained geometry because it is a crystalline form that whatever
potassium dichromate we make which is highly crystalline which is non hygroscopic it cannot
absorb water if you keep it for a longer period and this highly crystalline and the purity is also
very high it is not decomposing with time with air and oxygen in the of the air
so what we get over
there that this can be utilized for any oxidation reaction or the redox titration
so if your
unknown solution contains fe two plus
so fe two plus we can take in the conical flux and we can
titrate it with dichromate and this dichromate in ah this buret
so we have this in the buret and
we get the corresponding titration
so which is thing is that the dichromate is they are having
some known concentration
so this dichromate is having some known concentration

say n by ten dichromate solution
so n by ten dichromate solution we can you use
to identify the corresponding unknown solution of iron
so this iron
so the corresponding titration
between fe 2 plus and cr 207 we should know and how we can detect the end point that is also a
challenge
so we should know what is the indicator say particular indicator we call this as the redox
indicator
so barium diphenyl i mean sulfonate is used which at the last drop of dichromate
solution can changes this color when all the iron is exhausted and that can be indicated by the
corresponding exhaustion of the iron solution from the medium
so by knowing the concentration of the
standard solution standard primary solution for the volumetric analysis of iron we can identify
the unknown concentration of any iron sample so it can be any iron ore it can be any iron material
or any other species having iron species in there
so not only iron because since we are
utilizing the oxidizing agent the dichromate as the oxidizing agent for oxidation
so the
other species also this iodide can be oxidized similarly we can oxidize tannis ion sn2
plus by using dichromate then h two s we can use and obviously this fe two plus we
know that this fe two plus can be converted to fe three plus
so all these reactions that means
the reactions with dichromate we should all know this is there in your textbook and you can learn
also nicely for this but the only thing is that the what is the type of reaction it takes is
taking place over there whether this iodide is only oxidizing to arden or not
so that is the
oxidizing ability how strong your oxidizing agent is because the e 0 is known to us this e 0 is
important
so this 1.
33 volt is important
so how strong that is to convert iodide ions to the free
iodine because iodine is liberated and sometimes if it is saturated one the solid iodine crystals
are seen floating over the solution what we are titrating
so this is there but whether this
particular thing can oxidize further that means addition of oxygen simply that means ultimately
we know that this can be oxidized to iodine ion like chlorate perchlorate etcetera
so it can
also be oxidized by r date

so we should know the corresponding product and the number of electron transfer reactions similarly for s n two plus we should know that it is definitely going to the stannic state that means if this four plus state similarly the reduction of h two s and we should also side by side know another sulfur bearing compound is a s two o three two minus which is the anion of thiosulfate so anion of thiosulfate if we know that anion of thiosulfate how it works on this particular dichromate so dichromate how it is reacting with this and how it is reacting with h2s so that will give you the corresponding liberation of sulfur in the elemental form that means sulphur as zero so this is all about your chromate and dichromate thing so simultaneously or the parallely we can have the two other compounds which are very important and analytically also important those are like dichromate those are permanganate and manganate and there also will see that this permanganate and manganet we can have the ore like that of our chromitor in this particular case it is the pyrulocyte and this pyrolocite can be fused not by our sodium carbonate what we have used in the previous case to get the melt again the melt this is the particular process also for identification for both that means the chromium and manganese these are the special test or the fusion test or the formation of the melt to get the corresponding species which can be identified very nicely so here also we can use a mixture of koh or no h or k n o three simply the k o n a three which both you can go for the corresponding supply of potassium ion because the cations you have to supply the potassium ion the sodium ion and also some amount of oxygen and in this case the fusion process is little bit faster so fusion with potassium nitrate is faster so melt is forming there like that of our chromate which is giving rise here also the manganate which is the green melt so we get the green melt so we add water cold water is added and little alkali we add and that particular little alkali is basically because this particular thing is stable in alkaline medium so we get a so it is green melt so we get a green solution so from this green solution we go for evaporation so is this evaporation is basically if we use potassium it will give you k two m n o four so that k two m n o four is the green solution

which can go for the reaction with water forming permanganate as well as manganese dioxide
so this
can be converted or electrochemically this can be oxidized
so this simple direct reaction of these
with water molecules
so three of these can react with two of these water molecules to give us the corresponding species as twice k m n o four plus m n o two
so some part of the manganese is lost as again back of this mno2 that means dark
brown m n o two compound plus four k o h
so this k n o four definitely like that of our
titration process that means the permanganometry we can do with this k mno4 solution but this can
change concentration with time and which is also not very pure
so it is not a primary standard
solution this is a secondary standard solution and which can again be made
so you can take this
in buret and unknown iron two plus in solution so not only iron two plus many other thing because
this since it is a secondary standard solution it can be standardized with oxalic acid which
is a primary standard by knowing some amount of oxalic acid in a solution of say in the
strength of n by ten
so either sodium oxalate or oxalic acid we can make and that can be used to standardize this solution and ultimately iron in the conical flask can be titrated with a
corresponding just standardized solution of k amino 4 by oxalic acid for conversion
of this f e 2 plus 2 f e 3 plus to know the corresponding unknown concentration of iron
in the medium
so any other reducing species
so any other reducing species we can utilize for
this and this particular case that means when we use the potassium permanganate and potassium
permanganate titration in acidic medium that means h plus its e zero value is plus one point
five two volt but in all other cases the number of electron transfer is different in friendly
alkaline medium which is giving rise to the formation of this both that means the m n o two
and this k o h like that
so the permanganate ah can directly give you m n o two in the friendly alkaline or the neutral medium but your e zero values are different
so this can also be oxidized
for some important species like nitrite we all know that the nitrite is a very important species
to study
so this nitrite can be oxidized to nitrate in presence of water again water and this
water
so nitrate

so any unknown concentration of nitrite can be titrated for this using this potassium permanganate to convert it to nitrate

so this is a typical example

instead of this estimation of iron you can analyze the unknown nitrite concentration also in

solution by permanganometry ok thank you very much you