welcome back to electrochemistry class
so let us look back what we have
studied
so far in this few lectures so   if we look at the topics that are expected to
be covered in this series of lectures are like conductance in electrolytic
solution
that we have taken up in details   and we have also tried to explain how this
conductance of solution will will vary   due to several factors like
concentration may be like dilution and maybe temperature in this regard
we talked about also specific conductance and   specific and molar conductivity
then we also
discussed this variation of conductivity with   concentration and important
important thing
that important concept we have learnt over here   here is cholera's law of
independent migration
of ions that at infinite really dilute situation   all the ions are free to move
and there is
probably i mean most likely there is no inter   ionic attraction that is
internal attraction
is a minimize and ions can prove ions can   freely move and therefore therefore
you know molar
conductivity of an electrolyte that is basically   molar conductivity some of
the molar
conductivities of the constituent   ions then we have try to learn
electrolysis electrolysis means it is   it is electro means while you apply
some
electricity from outside through a pair of   electrodes then your material is
lysed that
is broken down into pieces like water if you   electrolyze it is broken down
into pieces like
hydrogen and oxygen that in that case you need to   supply electricity from
outside means you need
to supply energy
so that
so that the reaction   i mean this breaking reaction lysis reaction
can take place and also we talked about this laws of electrolysis that is
paradise law of electrolysis just we   gave the elementary idea then we also
talked about
this dry cells like lyclances cell then also we   talked about this electrolytic
cells then galvanic
cells then lead accumulated that is lead acid cell   lead acid battery which is
used in like in car
etc also we have talked about electromotive force   of a cell and
electromagnetic motive force is
nothing but the the reversible cell potential   when you draw you know zero
current from the from
the cell then the cell reaction net cell reaction   ah becomes i mean the cell
reaction or
the electrode reaction become reversible   that is perfect reversibility
condition is
maintained and therefore thermodynamics of   reversibility reversible
thermodynamic
principle can be simply applied to that   and we also talked about standard
electrode

potential that standard electrode potential is the potential when in activity of the of the electroactive substance is ah unity or maybe it is ah it is ah i mean one molar con at one molar concentration or may be unit ah concentration then you also used nars equation although derivation was not done over here just the statement of nernst equation that connects the cell potential connects the cell potential with the reaction quotient of the reaction that is involved in the in the cell and also we have given we have discussed a number of applications ah in connection with this electro chemical i mean this emf measurement like ph of the solution how ph can be measured using emf measurement or maybe how can we follow the precipitation i mean this redox reaction that we also have discussed over here and also how to find out this solubility product of a sparingly soluble salt and that we discussed in in the light of this emf measurement now how emf can be measured it is not with the help of a voltmeter but it is it is a basically a potentiometric measurement where you draw a zero current so it is called the pogendops ah compensation method

so progendops compensation method has been applied to apply to determine the emf of the cell various types of electrodes i mean half cells were also considered and we also attempted construction of this of cells ok construction of cells based on the requirement based on the net reaction we have given one or two example of that then we we ah found out the relation between the gibbs energy change and the emf of of the cell

ok these are the things that we have covered

so far now ah some more things are yet to be covered over here ah first of all ah one is fuel cell another is corrosion these are the two important aspects and and maybe we will just talk a little about redox reaction because this electrochemistry basically deals with this it is nothing but ah the redox reaction in i mean it is an electrode process ok it is it is the redox reaction

so therefore therefore what what is happening that when you when you construct a cell when you construct an electro chemical cell then there occurs ah there occur some chemical reaction and at the electrode at the electrode what is happening that in one electrode there will be you know oxidation and in the other electrode there will be reduction now i already have discussed this point that when you dip one metal when you dip one metal in its electrolyte solution then either the

metal has the tendency to accept electrons   from here from this and becoming it will
become more negatively charged it will acquire   more negative potential over over here and this
one becomes positive or in other words this   metal will lose electron and then it will
get dissolved over here ok in this way this   acquires a negative potential with respect to the
solution and the reverse may also take place that   that you have the electrode which is dipped into
the electrolyte solution and what will happen   that that the the ions over here ions over here
will accept electron and electron from here and   get reduced and it will it will be deposited
on on to this metal
so in that case in in that   case it will become your positive richer so
when you connect these two then it will form   it will form ah an electrochemical cell only thing
is that while constructing this electrochemical   cell you have have to keep this in mind keep
this in mind that your net cell potential   net cell potential will be will be greater than
0 if it is greater than 0 means the cell reaction   as represented for this e cell will be spontaneous
that is delta g will be negative that is reaction   will be will be spontaneous in the direction shown
with respect to this e cell greater than zero
so redox reaction means basically in in in in in
case of redox reaction what we do that we pick up   a specific redox reaction and then what happens
that we we dip one electrode in that redux couple
so that this redox reaction is taking place by
means of the fact that this electron exchange   will occur through this electrode and as a result
of which one electrode will acquire some positive   charge and the other electrode will acquire
some negative charge and when these two are   connected that means the potential relative
potential of these two negative potential of   these two are same
so therefore with
respect to this one it is negatively   negative it will acquire some negative potential
and this will acquire a positive potential   therefore from external source if you connect with
with with wire then current will flow from this   direction from here to here and electrons will
flow like this
so therefore this redox reactions   are are very important
so if there is no redox
reaction then you know if it is say for example   is say a precipitation reaction say for example
a g n o three plus c l minus that gets you   agcl plus nitrate minus
so directly you cannot
you know directly you cannot since it is not   a redox reaction you cannot ah

you know form a
cell like this but what you have to do you have to have have a an indirect way of measuring
the parameters for this reaction that you will construct a redox process such that
the net reaction will be like this
so therefore redox reactions are of immense importance
as far as this you know electrochemistry study of electrochemistry is concerned next is
another important thing that we should keep in our mind that while while we were discussing
this electrolysis then what happens that that you have two electrodes and you apply some ah
potential difference between these two electrodes
so it is grossly stated that that negative ions
will be attracted by the positive electrode and negative ah negative ions will be attracted by
the positive electrodes and positive ions will be attracted by the negative electrodes
so that
generally happens when these ions are this ions are are in close proximity to the electrodes
so that it can it can you know it can fill the potential potential fill a potential gradient but
if if this one is placed at a very long distance then practically this ion has the option to move
in any direction in any direction means it can move in this direction or that direction okay
so but those ions those negative ions which are which are close to this electrode will be
attracted and ah and if the you know potential is such that that this ah you know electron transfer
is favorable then this this ion will be discharged i mean this ion will be will ah i mean we will
will you know lose one electron over here and then it will it will be it will be discharged
in the same way this will happen for the plus
so therefore therefore discharge is taking place
or the redux process is taking place very close to the electrode but here it has got the provision
to move randomly but statistically what happens that if these these ions are you know converted to
their corresponding discharged counterpart then on an average the the concentration concentration
of the negative ions will be reduced over here the system
so system will face if you know a
concentration gradient there a concentration gradient will be produced
so in order to you
know equilibrate this gradient i mean in order to minimize this gradient again you know ah
negative ions will be will be coming ah you know in the vicinity of this
so this way things will
happen and net effect is that as if the negative ions are attracted by the positive electrode from

from any position
 so it is it it is not as simple   as that
 so so only there when when when these
ions face the potential difference or a potential   of this electrode only that happens when
this is coming at some appreciably close ah   separation because
 so that it can fill the field
otherwise at a larger separation you may not be   able to or the iron may not be able to feel
the field
 so these are the few things that   that that you should remember next we
will let us ah let us turn our attention   to ah to those two topics one is this ah
fuel cell and the other one is ah corrosion fuel cell now we have we have learnt ah cells
cells means the the device that can supply   electricity like the battery or the lead
accumulator or lead acid cell that is pbpo2 this   this thing now what happens that   in case of ah in case of normal cell
like say for example lake lances cleanses ah this dry cell we have discussed this point that this dry
cell is good until until all the reactants are   are exhausted or you cannot keep this dry cell
for very long time this is because of the fact   that this this is this will discharge there will
be a self discharge that is there is there is   internal resistance
 so electricity will will
you know ah we will will you know flow across   the electrodes against that internal distance and
it will automatically get discharged if you keep   the cell for long time and that is also going
to happen in case of this lead acid accumulator   that that they are also there they are also
internal you know discharges is possible
 so therefore
 so these electrodes i mean this this
ah cells are good until the the the you know ah   chemical substances ah are you know available over
there i mean those chemical substance which are   involved in the chemical reaction to produce the
the the electrical energy
 so therefore
 so supply   of electrical energy from the chemical reactant
ah basically from the from the chemical reactant   is stored within this cell and then then then
what is what is happening the reactants are reactants are consumed and one situation will happen that
all the reactants will be consumed
 so what will happen then if all
the reactants are consumed then   nothing is remaining
 so the cell reaction is
not going to is not going to proceed any further   process in the further means no further cell
reaction will take place

so cell will stop you know functioning
so cell will will become dead
so when reactants are consumed cell will become dead and then what do you do we throw the cell
cell away if we go to the market we buy new sets of um cells and then plug in those cells in in the
appropriate device
so therefore there is no way there is no way to reuse the cell or at least the outside i mean the cover of the cell ok what happens in case of your lead accumulator you can
recharge it and then you know you can you can use it again
so a number of cycles can be can be used
for recharging again and again but here it is not possible but suppose if the situation is such that
there is a mechanism by which you can take out the used chemicals and then you can feed the cell
with new set of chemicals unreacted chemicals then what is going to happen then you can expect
that cell to gain you know its power again that means cell will start to work again okay so
that's why as if you are i mean this thing means as if you are filling the cell like you fill
your motorcycle or you fuel your car you go to the gas station and you know pay money and then you
fill it you fill in fuel it means either you put petrol or diesel in the in the fuel chamber or
fuel tank
so so that means when once this fuel in the fuel chamber is exhausted you put new
new fuel in and then the system will continue to work again
so that is why that
so if there is a
mechanism by which you can you can you know refill it you can you can take out the the bad ones and
you can take the new ones
so ah
so therefore ah so that means you are filling the cell and therefore you can drive this
so you can fill the cell fill the cell and ultimately drive the cell
fill the cell or drive the cell
so this principle i mean this idea was first
demonstrated by group in eighteen thirty nine first this idea was implemented
it was demonstrated by group in 18 39 see see the idea was so
old that in that time ah people could could think about that whether we can fuel the cell ok
so it was i mean at that time it was known that water i mean as a result
of electrolysis of water water is decomposed electrolyzed to form h2 and o2 okay
so what group
tried was to was to recombine two you know ah these two i i mean this ah these two recombinants
recommend water and i am sorry i mean hydrogen and oxygen to form water okay
so ah so
basically these two gases gases are allowed to recombine in a specific fashion

so basically
it will be the reverse of electrolysis
so reverse of ok reverse of electrolysis ok
so um so
recombine h two plus o two to produce water and this will cause a potential difference ok against two electrodes dipped
over there
so a potential difference difference will be there across two electrodes present ok
so what is happening over there again you need to consider anode process and anodic and cathodic process
so anode process anode process anode process is h2 gas
that gets you 2h plus plus twice electron and corresponding potential is
0 volt because h 2 to h plus remember this standard hydrogen electrode
case that where you know electrode potential at all temperature is assumed to be zero
so
so so that is the concept and cathode cathode process cathode process is half o2 gas plus twice h plus plus twice
electron that gets you water and here e naught is equal
to plus one point two three two three volt plus one you remember if you
think about the reverse reaction then it is minus one point two three volt which we already
have used many times
so what is the net reaction net reaction is h two gas plus half
o two gas that gets you h two o liquid where e naught is one point two three volt ok
so this is the this is
the basic idea then in 1959 first working hydrogen oxygen based first working hydrogen oxygen based fuel cell was invented ah invented by francis t beckon ok now alkaline electrolyte nowadays
alkaline electrolyte is used alkaline is used in modern cells now what is the reaction anode reaction anode reaction is h two gas plus
two h minus gets you two h two o plus twice electron again e
naught is equal to zero volt then cathode reaction half o2 gas plus two water plus twice electron that gets you
to which minus e naught is equal to plus one point two three volt and
net is net is the same reaction net net reaction is h two gas plus half o2 gas that gets water with e naught equal to 1.
23 volt
so what is the what is the you know
pictorial representation of this
so pictorial representation will be like this it is like this that in one side you put oxygen in the other side you put
hydrogen h to fuel ok you have porous electrode
so that this hydrogen can diffuse in and also oxygen can diffuse and this is a porous electrode
so porous electrode and this one is anode this is cathode
so minus this is plus if you put this
against some external load then like then electrons will flow this way
current will flow this way the other way and the this anode reaction will be two h two
that gets to four h plus plus four electron cathode reaction will be
four h plus plus o two plus four electron that gets through water that means it

is it is alkaline
so therefore any which and each plus will be moving
this direction
so this h2 will will diffuse in and then it will be converted to
h plus and then it will move from this direction to this direction
so here you in input of
air that means o2 and here excess of air excess of air and unused o2 is coming
out so
this is a porous cathode this is porous anode and this porous cathode porous
anode
and the net net process is this ok
so only problem is that that
already i have discussed at one point that this oxygen consumption this
one this oxygen consumption process it's a it's a slow kinetically
slow process
so kinetically kinetically slow
so that you know puts a
problem for efficient problem against its efficient functioning okay
so therefore this
porous cathode if we replace this porous cathode with with some expensive you
know platinum cathode
then it has been found ah that such problems are mostly you know eradicated
so only problem is that
platinum is a costly metal
so it will increase the pricing of this device pricing of
this the cell
so therefore these are the this this is one of the one of the important
drawbacks for this this particular fuel cell
so what is happening that you are
feeling you are failing and this is the this is the ah this is the you know you
know excess of air or oxygen this is taken
out and also the reaction product is water so you see that as i when i started
discussion with
this then i was telling one thing that if you can remove the reaction product
and if you then you know feed the cell with new set of chemicals
have the same chemicals but new batch of chemicals then it will be filled i
mean this you are you are
feeling it ok you are feeling it and then after this reaction is taking place
again what will
happen you take out water
so this way you keep on doing
so you are failing you are gaining energy
and then you are taking out the reaction product this way this will continue
so therefore only
thing is that only problem is with platinum but you see you know this oxygen
it is readily
available from here hydrogen fuel you can you can get from electrolysis of you
know
water acidic acidic water you can you can get
so theoretically theoretically its
potential differences theoretically theoretically its potential difference is
about
one point two three volt at two ninety eight kelvin but in it has been found
because

of ah several other ah problems drawbacks   ah and that also depends on the pressure
of this air air then hydrogen and then   nature of the electrode and and
so if these
are considered then then it has been found   i mean if you consider all this um if those are
the those those create trouble then it will be   you will be means actually what
you get is that open circuit circuit the voltage is 1 volt around 1 volt it is
not more than 1 volt and if you put load with load   this reduces to about 0.
5 to 0.
8 volt ok
so this
this you know um this is called you know a fuel   cell
so so you are foiling it and you are getting
energy and it is it is continuing means you are   continuously fueling and you are getting the
energy
so that way it is it is it is happening   ok
so that completes the basic you know
discussion with respect to the fuel cell   then we will move on to move on to another another
important issue that that is called corrosion corrosion that is corrosion means because of corrosion you know
suppose you have a shining   you know iron uh you know material iron iron pot
in your hand and say you are not using that for   long time and you are keeping in keeping that nice
container iron container outside is shining ok you   are keeping it here here means in open ear that
may be may be which the problem is more during   you know any time
so you will be finding
that after some days after some days this   this shining color shining shining of shining
nature of this material this pot is gone and   some spots come brown spots come which
are called the rust ok
so therefore the   therefore the you know deterioration of this
material is there and this happens particularly   if the place is you know is having damp or during
you know rainy time but during winter time the   situation is little better that the probability
or the possibility that the materials will   lose its last year as a result of rusting
that is that is reduced or if you keep in you   know airtight con container or maybe if you
keep in a container material in a container   just removing the ex i mean removing this
moisture by keeping some hygroscopic material   inside that you will take take you know
moisture like calcium oxide or like that
so so then then this probability or this chance of
this corrosion will be reduced
so basically it is   the chemical reaction that is taking place at
the smooth surface of ah various metals ok

so so technically corrosion means spontaneously the
metals will return to their to their ore condition poor condition means as if you
are returning back your metal to i mean to their ore condition that means to their compound state ok
so electrochemical ah corrosion electrochemical corrosion means this
ah corrosion as a result of chemical reaction at the surface and some small cells are
formed and the net free energy for the cell reaction is such that the process
is spontaneous and ultimately the end product is that you say that the surface is
corroded
so therefore electrochemical corrosion corrosion is is is very important
so basically m to m plus plus electron so
this is the process
so and this is facilitated in presence of a suitable electron acceptor
that means this electron is free if electron is accepted by by something then the process will
be facilitated that metal will form m plus and therefore smooth surface of the metal will get
corrosion
so in presence of this is facilitated by facilitated by the presence of
presence of suitable electron acceptor ok and this is also known in corrosion language
that it is these are called depolarizer depolarizers sometime what happens that a
thin film of water or moisture a thin film of moisture moisture that is muscle which
is in the form of adsorption absorbed moisture can also
be can be very dangerous in respect of corrosion that it
will promote corrosion of the promote corrosion of the metal surface
so so basically the corrosion system
the system where corrosion is taking place that may be regarded as that may also
be called as it may be
so corrosion system corrosion system or the system where corrosion takes place
can be regarded as regarded as a short circuited circuited electrochemical cell
cell in which in which the anodic process anodic reaction could be we say for example metal to
say metal two plus equals plus two is electron the celebrated example may
be iron because the corrosion problem of corrosion is mostly with iron because we complain mostly
about corrosion i mean i mean the effect of corrosion or i don't like it i mean that people
does not like it that ok it is corroded
so it looks bad
so mostly ah that is involved with
that is involved with this iron
so iron two plus equated plus twice electron and
the cathodic processes may be and the cathodic process
so this is an this
is an ah anodic process that is that is at as if it is an anode reaction
so anodic process and cathode corresponding cathode reactions could be h plus
plus electron that is the that is an acceptor that gets to half h2 gas

so this is an
acceptor
so therefore in presence of acid that electron is accepted that that means
the
electron the electron which is which was liberated from the metal while it
produces this m m plus
or m two plus that will be that will be accepted by h plus to produce water ah
sorry to produce
hydrogen or maybe m two plus plus twice electron then it gets you m solid where
m is the metal ok
so corrosion is a is a is a two step process as i was discussing that one one
part is
a cathodic part another part is a is an anodic part
so cathodic cut means you know metal
will lose the electron and someone will be there to someone means some other
agent will
be there to accept the electrons
so that the drive of the driving force of the process
will be in in forward direction
so corrosion is a it is a two step it is having two steps having two steps
say for example if
we talk about this iron corrosion then first one is that in presence of you
know
moisture a film of moisture what happens that that the surface is coated
with moisture means the surface metal surface is having adsorbed moisture
on it
so therefore first step is iron that makes iron two plus iron ferrous ion
plus twice electron
so it it it dissolves okay and the the metal becomes this metal becomes
excess negative charge because of this one it is having excess of negative
charge suppose if
there is a mechanism that by which you pump this electron out then the process
will be more more
favorable but if there is a mechanism by which you put more electrons from
outside or or if you make
a situation that that that the environment is such that this particular system
is reluctant to
you know reluctant to remove this electron from here that means once the
electron is you
know accumulated over there it is very difficult to you know get rid of that
then the process
will not be very favorable
so so iron will try to iron two plus or iron will try to remain is
in its elemental ah state ok
so so what happens second step is
so correction corrosion
will will continue smoothly as the depolarizer or or the electron acceptor is
removing removing that that this electron okay say for example acid as i
mentioned acid
so two
h plus plus twice electron gets you h two or or like this is a b means like
say for
example if you have a more noble metal more noble metal
so metal ion

so what will happen c u two plus then
plus two is electron that gets you cu okay or maybe even even if there is oxygen
situation is like if there is oxygen and this oxygen is available in air
so if there
is oxygen what is may be a problem o two so o2 can again create an additional travel like this plus four water that produces four electrons plus four h minus
ok and this four which minus will combine with i mean this h minus will combine with iron
two to produce this hydrous ferrous oxide this will produce hydrospheres oxide which is called the rust
so so it will look bad
i mean the the surface will look bad
so then then how to get rid of this how to get rid of this means
so these are the possible situations that you have like problem is that that you have
a copper sulphate solution that you know some somehow copper sulfate solution has spilled on the iron surface and little bit of moisture is there then what is
going to happen thing is that that the tendency of copper and because this is in in the lower side
i mean it is easy to reduce than this one
so this one will be difficult to reduce
so so the thing
is that this reaction will proceed at the same time this reaction will also process
so metal
to metal ion and here metal into metal this coupled process will take place because the net
thermodynamics of this process is very favorable
so that's why more if more noble
metals are present then it is a trouble ah more noble means more noble than iron
or the corrosion of the concerned metal ok and also suppose if you if there is a
spillage of acid then it will you know induce you know more corrosion suppose you have a
little corrosion if by some means some acid has spilled onto the onto the little corroded surface
then the corrosion will be more efficient and then corrosion will spread all over the surface
of this iron
so this nice ah you know shiny surface will be will be you know damaged
so therefore corrosion is a real trouble ah to us and at the same time suppose you
have you can you can paint the ah the i mean the shining iron surface with the help of
a of a specific pain the point is that that
so it is this paint is on the surface
surface of the of the this metal so if your paint is not that good then what will
happen when water will fall on the on the surface of the paint it will

penetrate and go inside and
will will stay in the in between this iron surface   and this this paint coating
so that means it is
it is practically a thin coating of moisture water   and if that moisture stays for long time what will
happen
so this surface i mean this metal surface   on which this nice coating of this paint is
there
so in between that there will be corrosion
so when corrosion is there this hydrospherus
oxide will will come will will will prod will   be produced over there and this hydrosphere
is oxide is basically having more volume   ok
so it will it will have bigger
larger volume
so it will just   bulge out of ah out of the surface
so therefore
therefore it will it will look that that some as   if some blister looking thing on the surface
of i mean across the across the paint ok
so therefore if you give a little pressure then
it will break and then paint will also go and   ultimately the good look of this painted stuff is
lost
so therefore it is very important that if you   use very efficient i mean material ah very
efficient in the sense that if you use a   water repellent material like teflon or or
similar material then the possibility that   this water moisture will go inside and reach
the metal surface that will be reduced i am not   telling that it will be it will be removed
but it will be reduced ok
so that is why   that is why you know you know covering the metal
surface with appropriate thing is very important   ok or maybe in some cases oil if you have oil you
know oil coating that is also good but the point   is if oil is having some moisture then its a real
difficulty ok
so so um sometime if you cover the   surface with ah thin oxide then then that will
inhibit the anodic dissolution process ok so   ah anodic dissolution process means m to m n plus
this anodic dissolution processes is inhibited   if you use this oxide film or oxide paint and
if metal is ah now the point is if the metal is   this metal surface say say on which this
corrosion is taking place if this is   that one is little biased with negative potential
or if it is having excess of negative charge   then the tendency that an additional metal atom
that it will it will lose an electron and give it   give it to this metal surface and it will dissolve

this tendency will be reduced because already the metal is having excess of
negative charge
so so
dissolution um will be you know will be difficult in this way dissolution will
be difficult
so so
if you have if you have a coating onto this metal surface the metal i mean the
coated metal i mean
the metal which with which you will you will coat the iron surface say for
example if it is more
ah reactive than iron like say for example if you if you have a coating of
zinc zinc metal on iron
then zinc will tend to get i mean zinc itself will tend to get corroded
because with with moisture
i mean it will just become zinc two plus plus twice electron and this twice
electron means this
twice electron will stay on to twice electron will stay onto the metals ah
metal surface metal
means originally the iron surface
so then then what will happen that iron to iron two this
process will be inhibited because this is already having excess of ah excess
of negative charge so
therefore ah um
so the i mean basically the metal sheet metal sheet i mean irons say for
example
iron sheet will have will have negative charge on it because of this reaction
because it has
dissolved
so it ha it has left two electrons onto the metal surface
so therefore therefore look i
mean corrosion which which may be a local process that local process will be
will be sluggish or
in some cases it may be reduced to a to a greater extent
so that is why you know coating of like
zinc coating on this iron iron sheet has been has been found in in many many
cases ok
so thats
why
so these are the ways by which you can i mean you can you can reduce the
extent of corrosion
but corrosion is a is is really a problem because i mean in atmosphere you
have oxygen in
atmosphere you have moisture ok moisture the amount of moisture may be less or
may be more
but it is there
so if you keep on exposing your metal surface this metal if the it is a
reactive
metal metal surface ah with respect to this ah moisture then what will happen
that a thin film
of air will be there and that will create trouble
so its a real real ah difficulty ah you know in ah
day to day life
so therefore like
so things will be corroded and it will it will guess get rust

and if there is rust then then the longevity as far as the longevity of the
substance like ah
you know mater you know ah you know material ah like like ah say for example
ah
so you
know like if it is car or motorcycle or maybe may be iron maid substance
things
so all will
be will be eventually damaged if it is exposed to moisture or suppose if it is
kept in open
ah sky and during you know rainy time it will get you know water and then you
will be finding
that after rainy season is over it it gets a thin coating of this brownish ah
rust on it and if you
keep keep it for longer time then it will continue to increase
so that is why you need to scrap it
and then probably with appropriate oxide coating or may be appropriate metal
coating like drink ah
can prevent its further damage and may be life of this this thing will be will
be you know increased
so
so ah while some summing up ah what we have studied in this ah particular ah
piece of ah lecture that we have tried to sum up the some of most of the
things
that we already have studied over here during the earlier lectures now in this
piece of
lecture we have you know talked about this ah this corrosion and also we have
talked about
fuel cell which is a very important concept and
so so this fuel cell we we talked
i mean the basic of the basics of that ah has been talked about and also ah
the
corrosion that is that is a and it is a problem as far as electrochemistry is
concerned
problem in the sense that materials are getting damaged due to this
electrochemical you
know processes on the surface
so so how this can be eradicated whether it is fully eradicatable
or not
so ah that is a question but at least we can we can try to minimize it
so this much for
today
so in in the next lecture probably that is the that is the final lecture in
this
electro chemistry session we will take up some numerical problems along with
some questions
we will discuss some questions possible and possible answers ah to make we
make you acquainted
with the possible you know questions maybe maybe may come in your mind ok
so and also possible
the miracle problems that you may attempt with attempt with you know attempt
while
discussing or while while while reading ah some of the books that is available
in market

ok
so so
so that will be taken up in the in the   next next lecture possibly that is the final
lecture
so till then have good time thank you you