a warm welcome to the class of electrochemistry ah in the last lecture ah we have talked about the molar conductance and its variation as a function of concentration for strong electrolyte and the variation follows a trend like this you see that there is a linear variation and if you reduce the concentration of the solution then it its value increases and ultimately i mean if you extrapolate this to concentration 0 then you will end up in getting a quantity which is called the limiting molar conductance or molar conductance at infinite dilution i have explained to you what is mean by infinitely dilute solution in connection with conductance i repeat that infinitely dilution means that if you further dilute the solution that does not bring in any change of the conductance of the solution that means all the ions are free to move there is no probably there is no inter ionic attraction and that is why it reaches some limiting value so this is for a typical strong electrolyte strong electrolyte which is assumed to be dissociated to the fullest extent all the time when you dissolve this strong electrolyte in water but if it is a weak electrolyte weak electrolyte like acetic acid so it dissociates as ch3coo minus plus h plus in in aqueous medium and what happens that if it is a moderately concentrated solution then this is not fully ionized if a fraction of the of of this left hand side is ionized to get you this proton and the acetate ion so therefore if you keep on diluting this acetic acid solution then the extent of this dissociation increases now now ah as i as i have explained to you like lambda m is equal to kappa times the volume so if you dilute the solution then although kappa is also also reducing that is specific conductance is also reducing but the value of this volume is much much i mean increase of volume is much much higher compared to the decrease of this kappa and as a result of which what happens this lambda m increases but on top of this an additional thing comes into picture is the is the this extent of dissociation or the degree of dissociation so when you dilute in addition to the increase of volume and there is an additional term which super imposes on to this effect of increase of volume is the extent of dissociation so extent of dissociation increases so therefore that is why so it keeps on increasing but this increase of this lambda m as a function of concentration when when this concentration is reduced that is as a function of dilution that it

does not follow a
linear trend but a non-linear curve like this is followed
so therefore direct extrapolation of this
lambda versus square root of c this expression is not good enough to find out
the lambda m 0 that
is the limiting molar conductance value for weak electrolyte incidentally you
know you can express
this lambda m for strong electrolyte like this lambda m is equal to lambda m 0
minus a square
root of c that's why we have you know use this plot that is lambda m versus
root over of c
or square root of concentration where a is a is a is a constant which depends
on temperature
then solvent of course water in most of the cases and electrolyte electrolyte
means the nature
of the electrolyte whether it is a one is to one electrolyte or it is a twist
one or it is
a three stone and
so on and also electrolyte okay
so therefore therefore in case of weak
electrolyte you know you cannot use this linear method of getting this lambda
m
so that is
why ah we need to invoke the concept of the scholarships law of independent
migration of
iron that at infinite dilution all the ions move freely and therefore you know
each
individual ion contributes to a definite extent to the lambda 0 m value and
that
this is this is the way you can find out so
so let us look at this acetic acid again so
how to find out this lambda m 0 for ch3 cooh
so you can you can find out by means of
this expression that lambda m 0 hcl then plus lambda m 0 c h 3 c o o minus n a
plus
and this minus lambda m 0 sodium chloride
so these are all strong
electrolytes
so there is no problem in finding out lambda m0 hcl or lambda m0 ch3coo
minus na plus or lambda m0 in scl
so that's why if you if you make use of these
numbers then you should be able to find out lambda m 0 for acetic acid the
idea is
that if you think about say for example lambda m 0 hcl it is nothing but
lambda 0 lambda
0 for c l minus plus lambda 0 for h plus and few numbers i mean few values for
this lambda
0 are like lambda 0 means ah infinite and i mean this molar conductance at
infinite dilution
that is we can write like this lambda 0 for various ions at infinite dilution
where the unit
is cements centimeter square mole inverse where iron is say for example h plus
its value is 349.

then for example lithium plus its value is 38.
6 in the same way in the same way for
other ions i am writing few of them   that for example calcium 2 plus it is 119
calcium 2 plus or maybe ah you know i mean for say for
example ch3 cool minus its value is 40.
9   then which minus its value is 199.
1 then cl
minus it is 76.
4 and
so on
so therefore suppose   for example if you want to ah want to find out
ah say for example the lambda 0 m for say hcl   then it will be lambda 0 h plus
plus lambda 0   c l minus
so just plug in the respective values
for lambda 0 and that will get you the value of   lambda 0 m hcl okay now the
point is how to find
out this lambda 0.

so there can be various way   one is one is by trial and error method that you
find out this and find out this experimentally   ok i mean if in order to find
out this you know
from experimental data
so what you have to do   you just consider several different types of you
know combination of this chemicals chemicals means   electrolyte and then by
trial and error method
you plug in different numbers for this you know   positive counterpart and the
negative
counter part and you may be able to find out   or you may be able to you know
arrive at some
numbers which will ah give you a faithful value   for this this you know lambda
0 quantities for may
be different ions but best will be to find out the   mobility of ions and
basically lambda plus
is expression is f into u plus or lambda 0   plus is equal to f u plus 0.

so by by experimental
procedure there are several methods by which you   can experimentally find out
this this mobility
mobility is is basically the speed bar unit   potential gradient that is volt
per centimeter
that unit
so unit potential gradient how much of   of distance that the respective ion is
you know
moving that is called the that is called the   speed of ions and or the ionic
mobility
so so this
is your faraday
so this number nine six five zero   zero times this will furnish you this
lambda zero
plus
so this way you can find out find out this   these numbers ok experimental and
then plugging in
these now these numbers as per requirement you can   find out this lambda m 0
for different

electrolytes
so therefore therefore for lambda m 0 c h 3 o cooh you are applying this cool
resist law of independent migration of ions lambda m0 ch3 n coona minus lambda m 0 in a c l
so plug plug in respective numbers and you should be able to find out this lambda 0 0 for weak
electrodes
so therefore direct determination of lambda 0 for weak electrolyte is not possible
because the the lambda m versus square root of c this ah this is not a linear trend that is why
you have to make use of this indirect method of finding out this lambda m 0 for weak acid
or or weak electrolyte ok
so now
so what is the what can be the application of these
numbers this lambda m 0
so one of the one of the important applications is to find
out the find out the degree of dissociation degree of dissociation of weak
electrolytes as i mentioned to you that why this conductance
i mean molar conductance of weak electrolyte um we look like follows a non-linear trend that
is because of this variation of degree of i mean because of degree of dissociation
because with dilution you know the amount the percentage of the undissociated acid or or
electrolyte will change and as a result of which you know the amount of ions will increase and
as an amount of iron increases
so it adds to the conductance of the medium and therefore you
know lambda m increases
so degree of dissociation you know is alpha is basically basically um
expressed like this lambda m divided by lambda m 0
so lambda m 0 means it is assumed to be to be
maximally dissociated and it is dissociated to some extent at a given concentration
so it is
called the conductance ratio
so basically for weak electrolytes say h a that gets you
a h plus plus a minus say it is an acid 1 minus alpha gets to alpha and alpha
so therefore
if the concentration is c
so it is c
so therefore therefore your equilibrium constant
is equal to c alpha square divided by 1 minus alpha and therefore if you plug
in the expression for this it will get you c lambda m square divided by lambda m 0 and then
lambda m 0 minus lambda m
so that will furnish the you know this this k a okay that is acid constant
for ah acid constant for ah for weak acid
so basically lambda a means it is not it
is at some concentration
so you will get it experimentally this this number because from

the from the graph say for example over here   from the graph if you want to find out say lambda
m for say some concentration over here then   the corresponding value is this for a given
concentration value you are getting lambda   m at this at this point
 so therefore you
plug in this information to the numerator   you plug in this information to the numerator
and the denominator comes from this application   of kohlra's law of independent migration of ion
so therefore this will furnish this will furnish   your alpha and you plug in this alpha value over
here it will give you some number over here so   therefore it is basically the difference in in you
know molar conductance at infinite dilution and it   is the molar conductance at some concentration
ok
 so this way you can find out the value of   ka for for an acid and similar will apply for
weak base or maybe some other weak electrolyte
 so conductance this is your conductance
ratio conductance ratio by the application of   conductance ratio you can find out this quantity
ok
 so few more points regarding molar conductance molar conductance molar conductance
 so lambda m is equal to kappa   divided by c over kappa is c siemens
meter inverse concentration is small   per meter cube now this c is basically
conductance equal to specific conductance into   a by l
 so a by l is basically 1 upon c that's
why lambda m is equal to kappa by c okay now ah
 so basically specific ah conductance into
a by l is your conductance
 so conductance   is basically here you know this is
lambda in molar conductance ok
 so ah
 so so now next is if kappa is if kappa is
expressed as siemens centimeter inverse   and concentration is expressed
as mole ah per centimeter cube   then lambda m comes out to be cements centimeter
square mole inverse okay now occasionally lambda m lambda m is expressed like thousand kappa
by c where c is the molar concentration molar concentration and lambda m is cements   centimeter square mole inverse ok
 so so
basically um this can be i mean expressed   with with this expression but make sure that
make sure that you adhere to you know certain   restrictions with respect to the usage of
concentration unit now at the same time i mean   parallel to the molar conductance another term is
used which is called the equivalent conductance equivalent conductance it is nothing but
definition is same only thing is that   it is the in this case your solution

will contain
one gram equivalent of dissolved electrolyte in place of one mole of electrolyte your solution
will contain one gram equivalent of electrolyte and basically the relation between lambda m and it
is it is lambda equivalent or simply it is written lambda okay
so ah relation between
lambda equivalence and lambda m is lambda m is equal to z into lambda equivalent where z is nothing but nu plus z plus equal to nu minus z minus square it is
nothing but the charge number for the for the electrolyte uh electrolyte in in question
okay
so so either equivalent conductance or molar conductance one can use ah for for any kind of you know studies now um basically equivalent conductance or molar
conductance why this ah this term is more important compared to specific conductance because
here we compare say two electrolytes having having some equivalent conductance or molar
conductance value with respect to their conductivity
so how to compare these these two
solutions
so in that case in order to have a good comparison you need to you need to have one thing you know common that is either ah the both i mean the compared solutions will have the same amount of ah or same mole of dissolved substance dissolved
electrolyte or same gram equivalent of dissolved electrolyte for comparison it it is more handy
than you know this simple conductance
so that is why molar conductance or in some cases equivalent
conductance ah the is used ok
so ah
so that's ah more or less i mean ah regarding that's all regarding this conductance
or specific conductance business now few simple problems that one can try out like calculate question like
standard question like calculate calculate lambda m 0 for say calcium chloride or mgso4 using standard data standard data
so that means standard
data means standard data for you know lambda 0 say for example plus or lambda 0 minus
so i have i have given you ah some numbers i mean some data some of the data for
some of these ions but but if you um you know consult any standard physical chemistry text or
text book on electrochemistry you will be getting a bunch of such numbers
so for that you have to
you know you have to make use of those number but in this case you have to consider one thing
that here the stoichiometric coefficient for this chloride is two
so therefore this stoichiometric
coefficient must be taken into consideration while while you know while calculating this because here

you have two chloride ions against one calcium if it is sodium chloride then one sodium is there
with one chloride here one calcium is there with two chloride ions
so therefore
so two
chloride ions means it is double in number
so so contribution from chloride chloride
will be double ok compared to the contribution from calcium
so that means whatever lambda
plus value is there you will just consider and then twice the lambda 0 minus value for the
contribution of the of the anode ok here it is a it is just 1 by positive and one by negative
so in that case stoichiometric coefficients are basically one ok
so make use
of this make use of the standard table or standard data try to find out try
to calculate this lambda m zero next is calculate estimate the value of estimate
the value of lambda 0m for acetic acid which you are given some
numbers if lambda m 0 for nacl chcl and sodium acetate is given or or in place of this you
can use the standard data to find out find out this lambda m0 for nacla cell and
sodium acetate and then plug in these information in information to the appropriate equation
to find out this lambda 0 for ch 3 cooh in the same way if the conductivity is
given another question if conductivity of solution is given
so can you find
out the dissociation constant of weak electrolyte like i i just explained to you
so finding out or estimation of estimation of dissociation
constant of weak electrolyte electrolyte um from conductance data conductance
data another thing is um another simple question that why does specific conductance
decrease with dilution why kappa decreases with dilution and while while while
while lambda increases this i already have explained to you that kappa
is basically related to the number of ions present within unit cube
so if you dilute
so number of
ions within unit cube that is that is decrease
so therefore kappa decreases but but for lambda
m since it is nothing but lambda m is kappa into volume
so volume increases enormously although
kappa reduces the effect of increase in volume is
so much compared to the decrease of kappa so
ultimately lambda m suffers an increase i mean some lambda m ah increases from certain value to
another value ok
so so these are all some simple questions that that you can ask ask to yourself
and then you can find out the solution to this ok
so next is we will will move
on to we will move on to ah before we move another question that ah
just come in my mind that why why ac is used used to measure conductance
conductance that is for electrolytic

conductance of electrolytic solution electrolyte solution and why platinized platinum electrodes are used okay
so this is because of the fact
that if you use ac current then if the alternation that is you know this it is it is a sign or maybe cosine curve
so if it is symmetrical in each half cycle
then what will happen that this will produce you know a pair of you know oxidized and reduced
product at two electrodes and in opposite cycle ah those two basically that pair will
be produced but in in in ah reverse way and
so that is why and and if you use a platinized
platinum electrode then those two will be combined like oxygen and hydrogen ok and combine to
produce ah produce this water back
so therefore this electrode is not affected but in place of
ac if you use dc then the electrode reaction will take place and eventually the electrodes will
be covered with ah gas like oxygen and hydrogen
so electrode will be affected and therefore
measurement of conductance will be hampered ok so now let us move on to move on to another phenomena
that is that is your generation of electricity generation of electricity you know conversion
of in this case basically ah making use of making use of of chemical energy energy to produce electrical energy electrical energy
so basically this it is called electro electrochemical cell okay
so here you know
whatever energy is released in a chemical reaction by means of a specific arrangement specific arrangement means you dip electrodes and
that you know energy will be will be captured by the electrodes and it will be converted
in the form of you know electrical energy
so that is a device in which one can convert
chemical energy into electrical energy ok
so think about a simple chemical reaction that
simple chemical reaction that you have two beakers one is one is having zinc rod zinc rot dipped into say zinc sulphate solution
in the other beaker you have copper rod dipped into copper sulphate solution and then
you join this ah this these two solutions okay basically if you if you just mix them then you
know zinc sulphate and copper sulfate will freely mix and then the situation will rather be more
complicated that's why you keep this separate this unit separate and then you join these two by the
help of a chemical a a it is it is ah electrolytic um it is uh i mean you join by electrolyte ah i
mean it which is called your salt bridge which contains some electrolyte either it is ammonium
nitrate or potassium chloride ah in agar agar ah you know gel
so that is full of potassium
iron and chloride ion or ammonium ion and nitrate ion in this and this is basically acting

as the you know joining joining line
so it is an electrolytic joining line between these two
solutions one is copper sulphate another is zinc sulfide and good thing is that neither
zinc sulfate nor copper sulfate is able to mix with each other by this arrangement and then
then you have if you if you connect with where with these two rods then you will be finding
that that current is flowing in this direction this is minus electrode this
is glass electrode okay and i mean plus of the cell minus of the cell
and your galvanometer is showing a deflection and electrons are moving in this direction
okay
so this is called salt bridge which contains kcl or nh4 in a 3 some electrolyte
so what is the chemical reaction that is taking place as overall
zinc solid that is rod plus cuso4 that gets you zinc sulfate plus
copper solid
so that means that means zinc will be oxidized and copper sulfate will be reduced okay
so so basically what what you do in in regular laboratory experiment what you can
do you take some copper sulphate solution and sprinkle some zinc dust then you will see a change
where the copper sulphate will be replaced by zinc sulphate and and copper solid red copper solid or
reduced copper solid will be produced
so basically here ah because of this chemical reaction some
chemical energy is generated which will be transformed into the electrical energy by means
of this arrangement this device which is called the electrochemical cell okay
so electrical
potential difference is found for this one is about is about 1.
1 volt ok
so for for
concentration of zinc because it is very important that this this number will depend
on the concentration of these ions one mole per dm cube decimeter cube so
it is called a galvanic or voltaic cell ok
so electrolytic cell
so ah
so this is a device for carrying out you
know in electrolytic cell that is that is there is a device for carrying
out this non spontaneous you know reactions
so basic principle is
like this in one case you will make use of the forward direction i mean and for the
back reaction you are making i mean for the back reaction you are applying some potential
from outside that is that will reverse the direction reverse the direction of the process ok
so ah therefore therefore you know um therefore what is exactly happening
so this basically
this arrangement is called the daniel cell daniel cell

so think about this part and that part
okay
so if you combine these two then the circuit will be completed and you know current will flow
so this part is called
so it is a complete cell
so if you divide into two this is called one half cell this is called the other half cell okay so half cell reactions or these are called
the redox reduction oxidation couple
so here oxidation is taking place here
reduction is taking place
so this is plus and this is minus of this cell
so this is
this two together is called redox couple or or it is one half cell this is another half cell
so now let us consider the half cell reactions
so let us try to represent in terms of half cell reaction
so half cell half cell reactions ok
so um reduction process reduction process is cu to plus plus twice electron gets you cu solid zero
so this is reduction
so complementary to this
reduction process there will be oxidation
so oxidation process zinc zinc will give you zinc to plus plus twice electron
so this is an oxidation process so
so basically what is happening
so the gibbs energy
of the spontaneous redox selection is converted to to electrical energy
so gibbs energy basically
gives free energy gibbs free energy is the free energy that is you know that is involved over
here free energy changes in some free energy changes involved for a spontaneous change so
for a spontaneous process delta g is negative that is change in gibbs free energy is negative
so if it is a spontaneous reaction then the spontaneous reaction for the spontaneous reaction
this type of you know half cell arrangement when these two are combined one with another then this
this gibbs free energy for the spontaneous redox direction will be converted to electrical energy
and this change in gibbs free energy if that is delta g that is nothing but n f e where e is the
cell potential f is faraday n is the number of electrons transferred okay like here two electrons
are involved for the reduction of copper and also two electrons are liberated here two electrons are
used up and two electrons are liberated okay so this liberation and this you know used up using so
these two usage and liver liberation these these are equivalent
so this is compensated by this

one
so therefore the reaction will be complete
so n is 2 for this particular case
so delta g is
equal to nfe
so if delta g is negative then you expect to have e e to be positive that means you
will have some positive you know cell potential ok
so so
so electro this galvanic cell galvanic
cell is a is an arrangement where you can catch this free energy change and then you convert this
into electrical energy
so that this electrical energy can be used for doing some some some work some some useful work it is not like a pressure volume work it is this this electrical energy
can be used up to do some some ah non pv work some some effective work ok
so in galvanic cell
what is happening that if you recall the last earlier slide that here you see that in zinc
sulphate solution your zinc metal is dipped or in copper sulphate solution your copper metal
is dipped okay
so therefore whenever such an arrangement is is happening is is made then it is
it is represented like this
so for galvanic cell galvanic cell you have metal and you have electrolytic or electrolyte solution electrolyte solution and a vertical
line to to just indicate that this is nothing but the interface of the metal and electrolyte okay
so basically electron transfer electron transfer means the electron transfer from metal to electrolyte or electrolyte to metal happens at this interface
so so a single
vertical line is just to represent that this metal is dipped in this electrolyte solution like you
know copper is dipped in copper sulphate solution okay now if there there are two electrolytes like
like here you see one is zinc sulphate another is copper sulphate then there these are connected
with the help of a solvent
so how to represent this arrangement
so this arrangement can
be represented like this
so electrolyte electrolyte one then electrolyte two and they are not physically mixed
i mean i mean you are not mixing copper sulphate with zinc sulphate
so they are
kept in separate containers so but they are connected with the help of a solid
so this arrangement is represented by by writing these two electrolytes side by side
and putting two vertical lines in between so that represents the salt bridge okay

so that
bridges this electrolyte one with electrolyte two okay
so so
so whenever ah this
arrangement is made that means that means you have this half cell you have this half cell
so total potential is nothing but the potential difference between these two
so therefore this half cell should have some potential this sub cell will also have some potential whether it is this electrode is positively charged with respect
to the solution or it is negatively charged with respect to solution that decides whether i mean
in which direction the electrons will be flowing if this is electron rich suppose if this is
electron rich or or if this is electron rich then what is happening that electrons will be
accumulating over here and if this is electron deficient then this solution will be will be
will be have will be having more electrons
so therefore what will happen therefore i mean as
a result of which this is deficient this copper rod is deficient
so therefore electrons will be
flowing in this direction
so and through salt bridge the circuit will be completed
so why this
one is this one is electron rich this is because of the fact that the moment you dip zinc and zinc
sulphate
so it will lose two electron and the zinc will have the tendency to go to the solution as
a zinc two plus
so these two electrons the zinc atom will leave over here okay and here what is
happening this copper sulphate will accept will accept two electrons okay two electrons from here
okay and will will become copper zero and will be deposited over here okay
so therefore this
will be this will be you know you know deficient in electrons
so as a result of which
this one will be this one will be this one will be positively charged and this one will be negatively
charged and therefore you know this is i mean this electrons electron will be flowing from this from
here to here
so basically it depends i mean i mean whether the the forward reaction or the backward
reaction will take place i mean when when you dip dip one ah metal in a solution like say for
example if you dip a metal in a solution of its constituent ion that means the this
half cell will be reversible with respect to that particular say for example if it is zinc
and if it is zinc sulphate then it is said that the electrode is reversible

with respect
to with respect to sulphate
so it is zinc   then zinc two plus plus twice electron ok
so
so the thing is that
so whether zinc will   try to be oxidized or copper will try to
be reduced that depends on the specific   characteristic of the metal in question
ok
so so
so that is what is called the   half cell potential
so if half cell potential
i mean half cell potential will dictate whether   zinc will have zinc will have higher
tendency to get oxidized or copper will have   more tendency to be oxidized ok
so therefore
whenever whenever we whenever we talk about   this redox process then then basically you can
represent this electrode reaction like this   or you can represent electrode reaction
zinc to plus plus twice electron gets using
so this is called the oxidation scheme this is
called the reduction scheme
so the corresponding   potential what you express it is called the
oxidation potential and this is called the   reduction potential
so actually oxidation and
reduction potential they are related to each   other by by a by a negative sign ok if oxidation
potential is x then reduction potential will be   minus x
so so therefore zinc to zinc two
plus twice electron or zinc two plus plus   twice electron getting you zinc
so we have to
follow a specific convention which is the up   convention that we should use the reduction
scheme always ok although oxidation scheme   can be used but but can be used but reduction
scheme is is you know prescribed by u pack so   therefore zinc two plus plus twice electron zinc
and corresponding phi phi means the potential that   is developed at this electrode with respect to
this solution is called the electrode potential   ok
so so therefore phi say for example zinc
two plus zinc it is represented like this
so the corresponding potential reduction potential
will be will have a representation like this   in the same way copper two plus plus twice
electron gets you copper zero and therefore phi   phi co2 plus cu
so so
so therefore in order to
you know to express the cell potential in order   to express the cell potential what you have to do
that e cell will be equal to is is given like this phi right minus phi left what is finite finite
means that is you have you have one cell i mean   like this okay

so plus place the electrode
where this reduction is happening okay so like here you have reduction means copper over
here and oxidation is zinc over here
so therefore whatever phi in reduction potential scheme
it is 5 right ok and this is 5 left it is in in again in reduction scheme but it is 5 left
so your cell will be 5 right minus 5 left because you need to have e cell which is greater
than zero to make the whole or the overall you know cell reaction spontaneous okay
so therefore
in in reduction in right hand and oxidation in the left hand but where phi is is nothing but the
is nothing but the reduction potential ok
so so
so what is
so what do we get out of it
so therefore it is in reduction scheme it is in reduction scheme okay reduction scheme means reduction
potential scheme that is using reduction potential convention as prescribed by pack so
e cell is equal to phi right minus phi left now there is still another term used for this
reduction potential is called the standard reduction potential okay standard reduction potential
so standard reduction potential is the is the or the standard half cell potential is expressed as phi 0 it is nothing but the
potential or the half cell potential when when the electrolyte concentration is is 1 1 or unity unity
concentration is unity unity for concentration or when the activity is unit activity of
say for example zinc sulphate is unity ok
so the corresponding potential or half cell
potential will be called as the as the standard half cell potential okay
so therefore therefore
what we get that e cell is the cell potential cell potential is nothing but phi right minus
phi left in reduction potential formulation now next is how to measure the cell potential
that is that is the electromotive force or the or whatever what what you measure like in in case of a cell it is written that 1.
5 volt ok
so how
to measure that ok
so to measure that you may use you may use a standard voltmeter but
this standard voltmeter is not recommended because of the fact that if you use a voltmeter that
draws a lot of current
so if it draws a lot of current then reversibility of the process because
because whatever we are discussing it is it is based on the condition that the reactions
are reversible ok
so in order to maintain the reversibility of the process you you

need to draw minimum current
so therefore   therefore emf is nothing but emf or electromotive
force is nothing but the cell potential   cell potential
so emf is nothing but
cell potential when limit this current goes to zero
so that means you you measure the
cell potential with a device which does not   draw too much of does not draw too
much of
current
so that is called the emf or electro   uh motif force okay
so therefore therefore
um what are the things that we we have   we have used over here one is half cell
okay then
when it is half cell then half cell potential like   phi then reduction
potential scheme where you have
to represent the reaction in reduction scheme like   copper two plus to copper
zinc to plus to zinc
so that is why this phi's are used here are   reduction potential then another
thing we have
come across is the standard reduction potential   when when the when the
concentration of the active
ingredient is or the ion is unity or the activity activity of the constituent
ion is is unity okay
that is iron with respect to which it is it is   reversible like for example
this is reversible
with respect to copper two plus this one is   reversible with respect to zinc
two plus ok so
when we have got this half cell potential then   then it is it is it is
customary to connect this
to half cells to form your cell
so when you we   have formed this ah you know complete cell then
the the question of e cell comes
so therefore how   to calculate or how to estimate isl it is nothing
but 5 right minus 5 left in reduction scheme
so therefore next comes one one thing that how
to find out this e cell you can use a voltmeter   but voltmeter is not a is not
a good job
so you
use um you know that is called the galvanometer   and with the help of a
specific method which
is called the pogendops compensation method pogendorf compensation compensation
method with the help of this method
you compare compare the no deflection point for   your unknown cell and for a
standard cell and then
then you just take the ratio and you will be able   to find out that that when i
mean i mean the ratio
of these these two quantities and as a result of   which in that case in that
particular arrangement
the current goes to 0 and you will be able to find   out the emf which is called
the reversible cell
potential ok
so so this is this is the method by   which we can find out the cell potential
cell
means it is a combination of two half cells   ok

so so um that's about this the preliminary
of of this you know galvanic cell
so ah in the next lecture we will take up several other
examples of such cells such galvanic cell will consider many reactions and
also will
will you know we will try to construct ah you know various cells ah based on
certain
chemical reactions and will take up some you know simple examples of this this
electromotive
force or emf measurement electromotive force means reversible that connects
the reversible
electrode potential ok
so so and and also will will ah try to have an attempt to find out the
half cell potential half cell potential means what is the what is the
potential for a specific
half cell
so in that case you have to make use of a known half cell and then with
respect to
that known half cell you construct the complete cell and then find out the emf
of this complete
cell where one half cell is known and the other half cell is unknown ok
so this way we should be
able to ah we should be able to find out the half cell potential
so we will take up the measurement
of upsell potential um in the next class and various applications of emf
measurement i mean
some of the applications of emf measurements in the next class
so that's
all for today thank you you