LAKSHYA

FOR JEE

LECTURE –12

Electrochemistry

By Sarvesh Sir

TABLE OF CONTENT

PW Maharathi

Because Practice makes a Maharathi

You have a TEST !!

Rewards for Students who attempt all the tests regularly on Sunday/ Monday!

- Top 3 Students in each month will receive a Gift Voucher worth Rs 500.
- Top 20 Students in each month will receive a Gift Voucher worth Rs 200.
- Lucky 20 students in each month will be selected on a random basis who will receive a Gift Voucher worth Rs 100 for attending regular tests.
- All the students attempting regular tests will be eligible for Live Teacher Interaction-Paramarsh(2.0)

MEGA MAHARATHI (Nov-2022 & May-2023)

- Top 5 Students will receive a Gift Voucher worth Rs 1000
- Lucky 100 students in November 2022 and May 2023 will be given a Gift Voucher worth Rs 500 under MEGA MAHARATHI.

** Eligibility and Rules are covered in the next slide.

DO’s AND DON'Ts TO BECOME A PW MAHARATHI:-

1). You have to attempt all the test occurring between the last Maharathi and till the next one to be eligible for Maharathi at all.

2). Maharathi will be announced only in the batch for the month if more than one test has occurred in that last month. For eg- If only one test occurred in June then that test would be considered in July’s Month Maharathi Results.

3). The combined performance of all the tests would ensure your selection in the toppers prizes.

4). The selection of **Lucky students** will be done using our Random Selection Algorithm and not on the basis of marks, names and past maharathi results, you just have to be eligible by attempting all tests and yes, if you have been selected once it can happen again :D

5). You are eligible in MEGA MAHARATHI if you have given more than 10 TESTS out of the 13 TESTS occuring in each of those halves of the sessional year(i.e MAY-NOVEMBER and NOVEMBER-APRIL) and not on marks or any other factor.

6). All the tests need to be attempted on Day of test (Sunday) or the next day (Monday).

7). You will have to attempt all tests genuinely and completely to be eligible for any scheme. We will use our Fraud check algorithms before identifying the award winners.

Q . 108 g of silver (molar mass 108 g /mol) is deposited at cathode from $AgNO_3$ (aq.) solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at 273 K and 1 bar pressure from water by the same quantity of electricity is

[JEE Main 2020-9 January (morning)]

20 Sec

No. of gram Eq. of Ag = No. of gram Eq. of O_2

$(n \times \text{mole})_{Ag} = (n \times \text{mole})_{O_2}$

$1 \times \frac{108}{108} = 4 \times \frac{\text{Vol. of gas at S.T.P}}{22.4}$

Vol. of gas at S.T.P $= \frac{22.4}{4}$

$= 5.6$ Litre

Q . 250mL of a waste solution obtained from the workshop of a goldsmith contains 0.1M $AgNO_3$ and 0.1 M $AuCl$. The solution was electrolyzed at 2V by passing a current of 1A for 1 5 minutes. The metal/metals electrodeposited will be [$E^0(Ag^+/Ag)$=0.80V , $E^0(Au^+/Au)$=1.69 V]

[JEE Main 2020-4september (evening)]

a) Silver and gold in equal mass proportion

b) Silver and gold in proportion to their atomic weights

c) Only gold

d) Only silver

mole of Au = M x V (Litre)

$= 0.1 \times 250 \times 10^{-3}$

$= 0.1 \times .25$

$= 0.025$

$1 \times (\text{mole})_{Au} = \frac{1 \times 15 \times 60}{96500} = 0.00932$ mole deposite huwa hai

Battery

* Number of galvanic cell arrange in series and form combination of cell, this is known as battery.

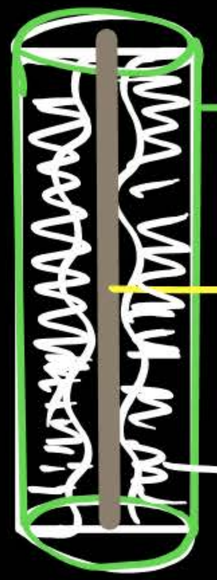
Type of battery

① primary battery ⇒ unreachargable
or
re-used nahi kr sakte

② Secondary battery ⇒ Reachargable
or
re-used kr sakte

Example of primary battery

(a) dry cell (La-lanche cell)



→ Zn-metal (Anode)

→ graphite rod (Cathode)

→ Electrolyte ⇒ $NH_4Cl + ZnCl_2$ MnO_2 paste

Anode → Zn

$Zn(s) \rightarrow Zn^{+2} + 2e$

Cathode

$\underset{+4}{MnO_2} + \underset{-3}{NH_4^+} \rightarrow \underset{+3}{Mn(OH)O} + \uparrow \underset{-3}{NH_3}$

$Zn(s) + MnO_2 + NH_4^+(aq) \rightarrow Zn^{+2}(aq) + \underset{(s)}{Mn(OH)O} + \uparrow NH_3$

$E_{cell} = 1.5\ V$

during the time E_{cell} decreases

$$E = E^{\circ} - 0.0591 \log \frac{Zn^{+2}}{[NH_4] \cdot P_{NH_3}}$$

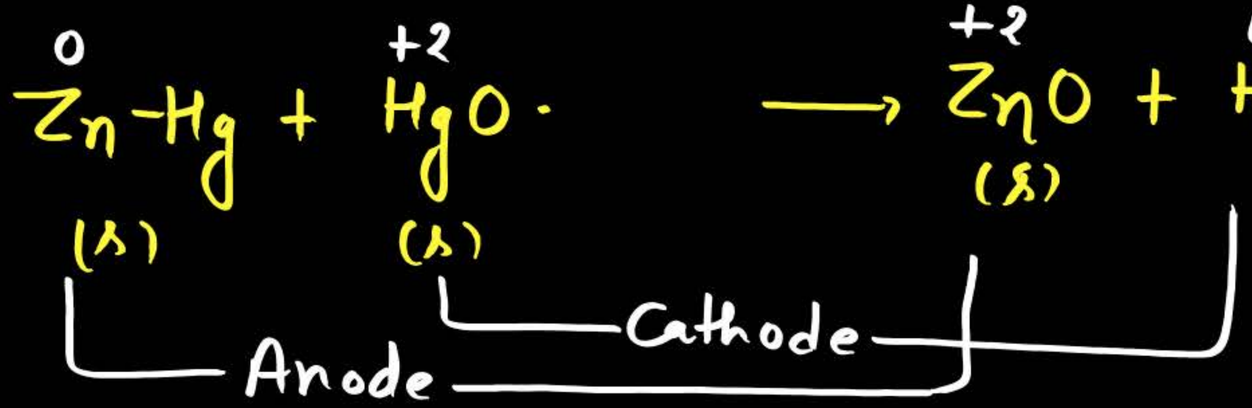
$$Zn^{+2}(aq) + \ddot{N}H_3 \longrightarrow \underset{(aq)}{\left[Zn(NH_3)_4\right]^{+2}}$$

Zinc - Hg cell or button cell

Zn-Hg → Anode

HgO paste - Cathode

KOH (aq) → Electrolyte



, $E_{cell} = +1.35\ V$

↓

during time E_{cell} of button cell does not change (Constant) and not depend upon Con. of electrolyte (9% KOH)

$$E_{cell} = E^{\circ}_{cell} - 0.0591 \log Q_c$$

$\frac{0.0591}{n}$

↓

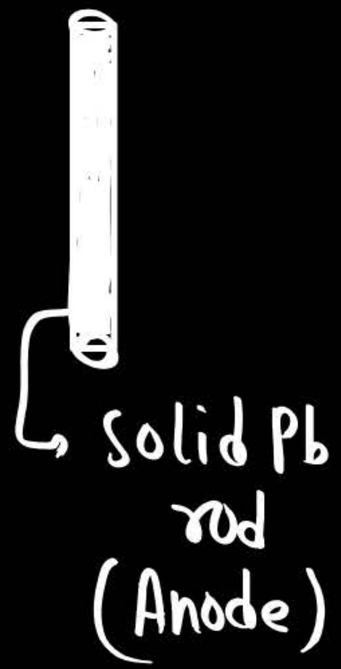
0

$$E_{cell} = E^{\circ}_{cell}$$

↓	↓
Const	Const

Example of Secondary cell

(9) Lead storage battery.



Solid Pb rod (Anode)

→ girid of Pb + paste of PbO_2

→ paste of PbO_2 ⇒ Cathode

Electrolyte = 38% (w/w) sol^{n}. of H_2SO_4

Anode $\quad Pb^{0} + H_2SO_4 \longrightarrow PbSO_4^{+2} + 2H^+ + 2e^-$

Cathode $\Rightarrow \quad PbO_2^{+4} + 2H_2SO_4 + 2e^- \longrightarrow PbSO_4^{+2} + 2H_2O + SO_4^{-2}$

Cell Reaction $= Pb^{0}_{(s)} + PbO_2^{+4}{}_{(s)} + 3H_2SO_4 \longrightarrow PbSO_4^{+2}{}_{(s)} + PbSO_4^{+2}{}_{(s)} + 2H_2O + 2H^+ + SO_4^{-2}$

un Reachargable rxn or discharge rxn

$E_{cell} = 2.041\,V$ → during the time, E_{cell} decreases

$E = E^0 - 0.0591 \log Q_c$

Reachangable Reachion

$$PbSO_4 + PbSO_4 + 2H^+ + SO_4^{-2} \rightarrow Pb + PbO_2 + 3H_2SO_4$$

$$E_{cell} = -2.041\ V$$

gain kr raha hai

Fuel cell

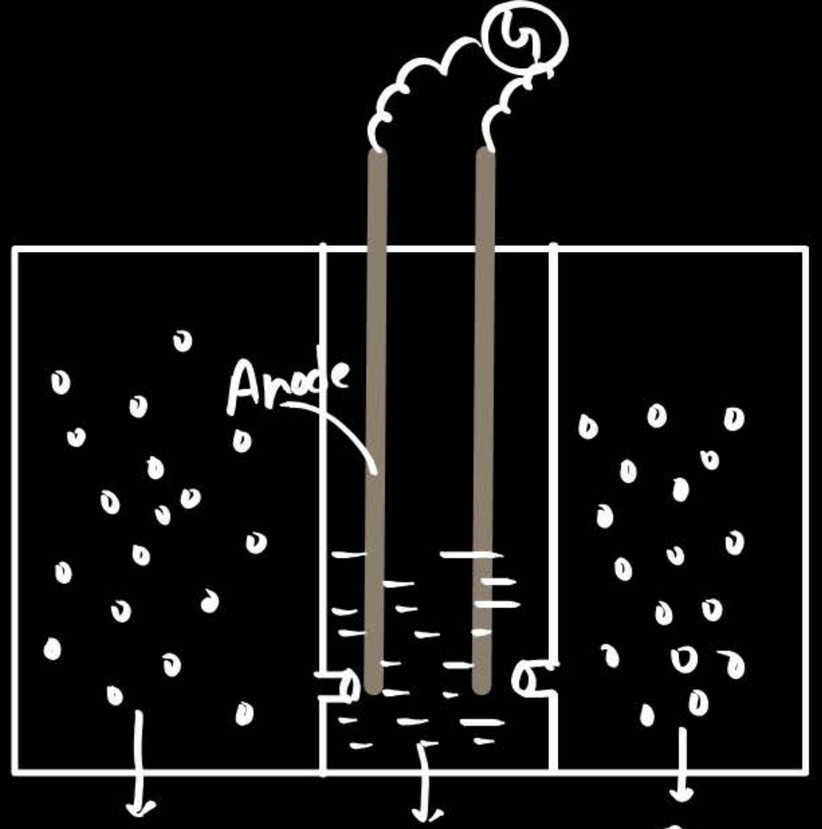
$$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l), \quad \Delta H = -ve$$

(Exothermic)

↓

thermal energy convert in to electrical energy by fuel cell.

Example → Oxygen-Hydrogen fuel cell



Anode

$$2H_2 + 4OH^- \rightarrow 4H_2O + 4e^-$$

(0) → +1

Cathode

$$4e^- + O_2 + 2H_2O \rightarrow 4OH^-$$

O_2: (0) → (−2)

$$2H_2 + O_2 \longrightarrow 2H_2O, \quad \Delta H = -2 \times 540 \text{ kJ approx}$$

fuel cell convert Krta hai electrical energy me

efficiency of fuel cell (η)

$$\eta = \frac{\text{Enthalpy of Rxn}}{\text{Electrical work}} \times 100$$

$$\eta = \frac{\Delta H}{\Delta G} \times 100 = \frac{\Delta H}{-nF E_{cell}} \times 100$$

* Hydrogen-oxygen fuel cell = 70% (approx)

CORROSION.

Metal → tendency ⇒ React with Atomsphere And Converted into its mineral Comp. (Oxide, Carbonate, SO_4^{-2} etc)

↓

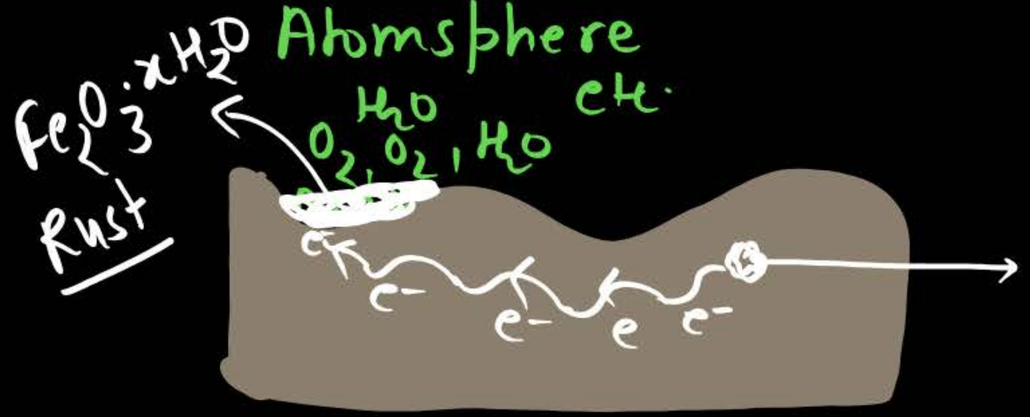
Spontaneous process.

$$M + \text{atomsphere} \longrightarrow M_2O_n \text{ or } M_2(CO_3)_x \text{ or } M_2(SO_4)_x$$

Natural tendency of metal to convert its mineral Comp. in presence of atomsphere ⇒ Corrosion process

Example of Corrosion

(a) Rusting of Iron



Anode $\Rightarrow$ $Fe(s) \longrightarrow Fe^{+2} + 2e^-$

Cathode $\Rightarrow$

$O_2 + 4\bar{e} + 2H_2O \longrightarrow 4OH^-$

Rusting rxn $\quad 2Fe(s) + O_2 + 2H_2O \longrightarrow Fe^{+2} + 4OH^-$

$Fe(s) \longrightarrow Fe^{+2} + 2e^-$ $\quad \boxed{E_{cell} = 1.23V}$ or FeO

presence of Atomsphere Fe^{+2} further oxidise and rust (Fe^{+3} oxide)

$Fe^{+2} + O_2 + xH_2O \longrightarrow Fe_2O_3 \cdot xH_2O$

Rust

HOME WORK

Pw Modules

Topic wise Exercise

Learning plus Exercise

THANK YOU