Types of battery :-

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① Primary battery :→

10 Primary batteries could not be recharged when it get discharge. The most familiar example of primary cell is
11 dry cell (also known as leclanche cell after its discovered). The cell consist of a zinc container that also acts as
12 anode and cathode is a carbon (graphite) rod surrounded by powder of MnO_2 (Manganese dioxide) and carbon.
13 The space between electrodes is filled by the paste of ammonium chloride and zinc chloride. When current
Lunch passes through the cell Cl^- ions combine with zinc and NH_4^+ ions move towards carbon electrode. The NH_4^+
14 separates into ammonia (NH_3) & Hydrogen (H^+) as given below:

15 At anode :-

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

16

At cathode :-

17 $$NH_4^+ + MnO_2 + e \longrightarrow NH_3 + MnO(OH).$$

18 MnO_2 prevents hydrogen from collecting on anode which could otherwise stop the cell function, this Sunday 14
19 process is known as depolarising action i.e. it stops polarisation of the cell. Polarisation of cell is the
20 process of accumulation of hydrogen near the anode which may stop the function of the cell.

Notes Primary cell mentioned above has the potential of 1.5 v.

(#) Mercury cell :- It is also a type of primary cell which is used for low current devices like watches, hearing aids, etc. It consists of amalgamated zinc (Hg + Zn) as anode, and a paste of HgO and carbon as the cathode.

The electrolyte is a paste of KOH and ZnO.

The electrode reactions are as follows :-

At anode :-

$$Zn(Hg) + 2OH^- \longrightarrow ZnO(s) + H_2O + 2e^-$$

(amalgamated zinc)

At cathode :-

$$HgO + H_2O + 2e^- \longrightarrow Hg(l) + 2OH^-$$

Net reaction :-

$$Zn(Hg) + \cancel{2OH^-} + HgO + \cancel{H_2O + 2e^-} \longrightarrow ZnO + \cancel{H_2O + 2e^-} + Hg + \cancel{2OH^-}$$

$$Zn(Hg) + HgO \longrightarrow ZnO(s) + Hg(l)$$

The cell potential is almost 1.35 V and remains constant during its life time as the net reaction does not involve any ion in the solution whose concentration can change during its lifetime.

(1) Secondary cell :-

Secondary cell is a type of cell which can be recharged after getting discharged. Recharging of cell takes place when external current is applied in the direction opposite to the direction when current is withdrawn from the cell. Lead storage battery

is a secondary battery.

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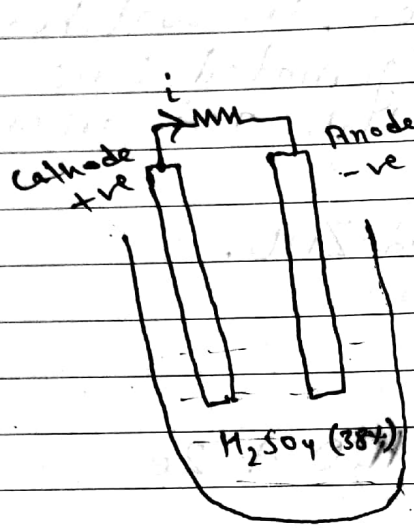

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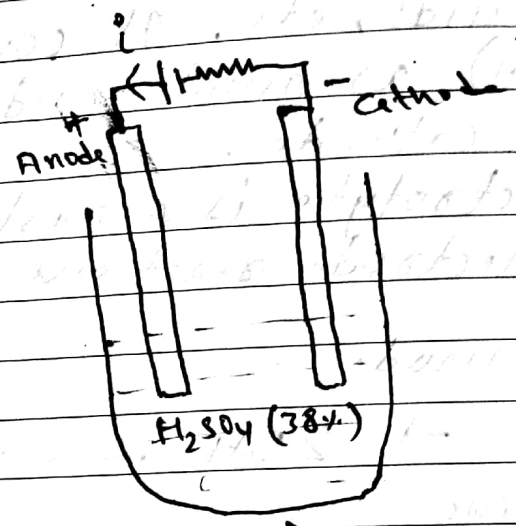

Lunch

Discharging of cell

Charging of cell

→ Lead storage cell consists of a lead anode and a grid of lead dioxide (PbO_2) as cathode. A 38% solution of Sulphuric acid is used as electrolyte. The cell reactions when the battery is used (condition of discharging) is given below:

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At anode

17 $Pb(s) + SO_4^{2-}(aq) \longrightarrow PbSO_4(s) + 2e^-$

18 At cathode

$PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e \longrightarrow PbSO_4(s) + 2H_2O(l)$

19

Net reaction :-

20 $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \longrightarrow 2PbSO_4(s) + 2H_2O(l)$

Notes As mentioned above $PbSO_4$ is formed at both electrodes when discharging takes place and the specific gravity of H_2SO_4 decreases gradually with decrease in voltage between the two electrodes.

The charging process is the reverse of discharging and the cell reaction taking place at two electrodes is given below

At cathode :-

$PbSO_4 + 2H^+ + 2e = Pb + H_2SO_4$

At anode

$PbSO_4 + SO_4^{2-} + 2H_2O = PbO_2 + 2H_2SO_4 + 2e$

Net reaction

$PbSO_4(s) + 2H^+(aq) + SO_4^{2-}(aq) + 2H_2O \rightarrow Pb(s) + PbO_2(s) + 2H_2SO_4$

During the charging process $PbSO_4$ is converted into H_2SO_4 hence specific gravity of H_2SO_4 increases with increase in cell voltage. When the secondary battery is fully charged its specific gravity is restored to the value 1.28. Another important secondary cell is Nickel-cadmium (Ni-Cd) cell which has longer life than lead storage cell but more expensive. The cell reaction during the discharging (when we use it) process is as follows :-

$Cd(s) + 2Ni(OH)_3(s) \longrightarrow CdO(s) + 2Ni(OH)_2(s) + H_2O(l)$