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J-Mains

3, 5, 6, 9, 10, 11, 12, 13

14, 15, 21, 22, 23, 24

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(3) $\left(\frac{0.1 \times 2 \times 3600}{96500}\right) = n_{H_2} \times 2 = n_{O_2} \times 4$

(9) $\text{eq of Ag} = \text{eq of } O_2$

$1 \times 1 = n_{O_2} \times 4$

(10)

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(24)

$10^{-6}m = 10^{-6}M$ HCl

$H_2 \longrightarrow 2H^+ + 2e^-$ $\quad E^\circ_{H^+/H_2} = 0$

$2AgCl + 2e^- \longrightarrow 2Ag + 2Cl^-$ $\quad E^\circ_{AgCl/Ag,Cl^-}$

$$0.92 = E^\circ - \frac{0.06}{2} \log [H^+]^2 [Cl^-]^2$$

$$= E^\circ - 0.06 \times (-12)$$

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Oxidation potential of H_2O

$$4H_2O \longrightarrow 4H^+ + \cancel{4OH^-}$$

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

$$2H_2O \longrightarrow O_2 + 4H^+ + 4e^- \qquad E^\circ_{H_2O/O_2} = -1.23 \text{ volt}$$

$$\left(E_{H_2O/O_2}\right)_{pH=7} = -0.83 \text{ volt}$$

$$A^+ + e^- \longrightarrow A \qquad E^\circ = -0.3 \text{ volt}$$

$$2H^+ + 2e^- \longrightarrow H_2 \qquad E^\circ_{H^+/H_2} = 0$$

$$\left(E_{H_2O/H_2}\right)_{pH=7} = -0.42$$

In case of cations, ion of

Cu Hg Ag Pt Au

will be deposited in preference to H^+ from H_2O in aq soln

In case of anions

$SO_4^{2-} < NO_3^- < OH^- < Cl^- < Br^- < I^-$

from aqueous soln

from dilute $Cl^-(aq)$ soln $\quad Cl^- < OH^-$

concentrated $SO_4^{2-}(aq)$ $\quad OH^- < SO_4^{2-}$

$SO_4^{2-} \longrightarrow S_2O_8^{2-} \quad E^\circ = -2.01$ volt

$NO_3^- \longrightarrow$

In case of Hg cathode

$H^+ < Na^+$

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Solution	Rxn at anode	Rxn at cathode	Nature of soln
$NaCl(aq)$	$2Cl^- \longrightarrow Cl_2 + 2e^-$	$2H_2O + 2e^- \rightarrow H_2 + \underline{2OH^-}$	basic
$CuSO_4(aq)$	$2H_2O \rightarrow O_2 + \underline{4H^+} + \underline{4e^-}$	$\underline{Cu^{2+} + 2e^- \rightarrow Cu(s)}$	Acidic
$CuCl_2(aq)$	$2Cl^- \longrightarrow Cl_2 + 2e^-$	$Cu^{2+} + 2e^- \rightarrow Cu$	Neutral
$Na_2SO_4(aq)$	$2H_2O \rightarrow O_2 + \underline{4H^+} + 4e^-$	$2H_2O + 2e^- \rightarrow H_2 + \underline{2OH^-}$	Neutral

$[H^+] = \frac{0.1}{10} = 10^{-2}$

10 lit

Q. (0.1 F) charge is passed through $CuSO_4(aq)$ soln. find [Cu : 64]

(I) loss in weight of soln

(II) pH of soln

eq of $O_2 = 0.1$

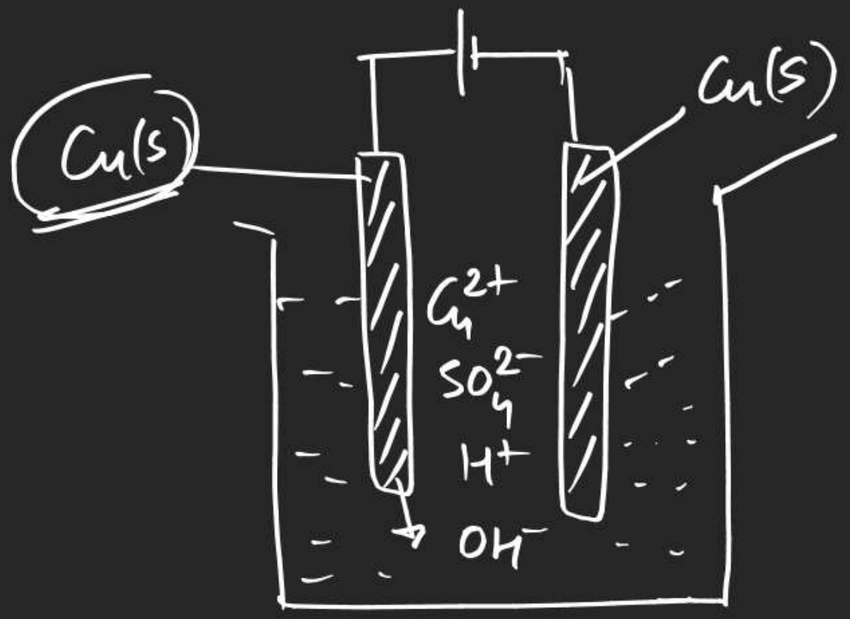
$n_{O_2} \times 4 = 0.1$

mass of $O_2 = \frac{0.1}{4} \times 32 = 0.8$

$n_{Cu} \times 2 = 0.1$

$\text{mass} = \frac{0.1}{2} \times 64 = 3.2$

Case-III if active electrodes are presents



If electrode potential are not given the consider the process to be of electrorefining or Electroplating in both cases Same metal ion oxidises and reduces at anode & cathode respectively

At anode

$SO_4^{2-} \rightarrow S_2O_8^{2-}$

$OH^- \rightarrow O_2$

$Cu \rightarrow Cu^{2+}$

At cathode

$Cu^{2+} + 2e^- \rightarrow Cu$

$H^+ + e^- \rightarrow H_2$

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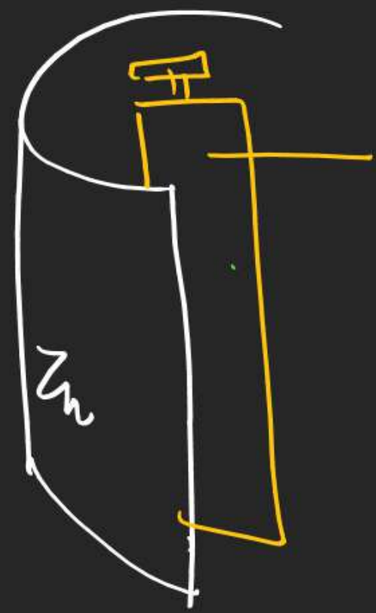
Cell & batteries

cells

primary (Non-rechargable)

Secondary (Rechargable)

① Dry cell (leclanche cell)



$NH_4Cl + MnO_2$

$E = 1.5$ volt

At anode

$$Zn \longrightarrow Zn^{2+} + 2e^-$$

at cathode

$$NH_4^+ + e^- \longrightarrow NH_3 + \cancel{\tfrac{1}{2}H_2}$$

$$MnO_2 + \cancel{\tfrac{1}{2}H_2} \rightarrow MnO(OH)$$

$$MnO_2 + NH_4^+ + e^- \rightarrow NH_3(g) + MnO(OH)$$

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(2) Mercury cell (button cell)

Anode $Zn(s)$

Cathode $HgO(s)$

$E_{cell} = 1.35$ volt

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

$$HgO + H_2O + 2e^- \rightarrow Hg + 2OH^-$$

$$Zn(s) + HgO(s) \rightarrow ZnO(s) + Hg(s)$$

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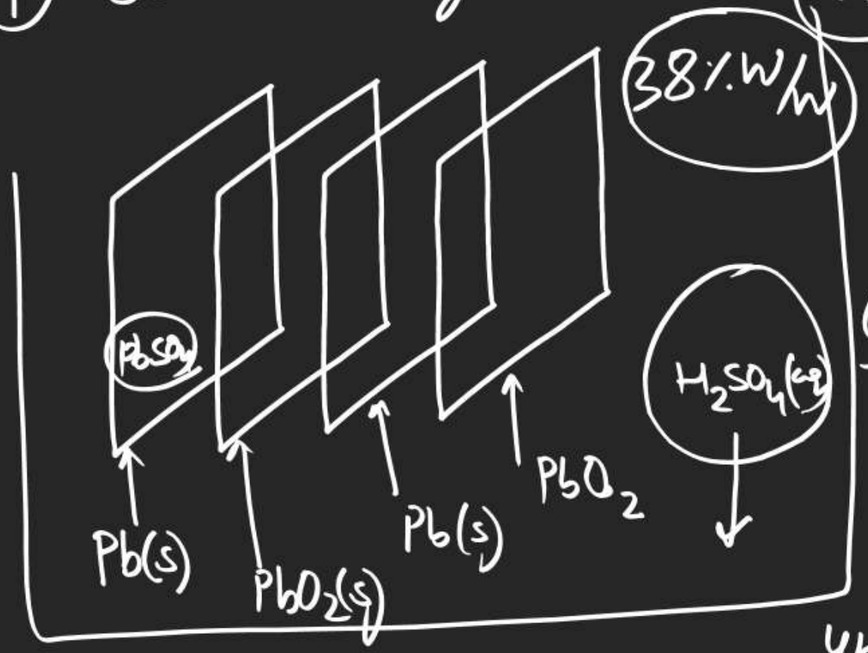
Secondary cell

① Lead storage batteries



During discharging

Anode

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

$Pb^{2+} + SO_4^{2-} \longrightarrow PbSO_4(ppt)$

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

Cathode

$PbO_2(s) + 4H^+ + 2e^- \longrightarrow \cancel{Pb^{2+}} + 2H_2O$

$\cancel{Pb^{2+}} + SO_4^{2-} \longrightarrow PbSO_4(ppt)$

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

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

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electrochem

O-I 52 - 75

S-I 43 - 52