$2(3) + 1 - 2$.

$\lambda(\Lambda_m^\infty)_{NH_4OH} = 440 \text{ S cm}^2 \text{ mol}^{-1}$.

$$\boxed{(\Lambda_m^\infty)_{NH_4OH} = 220 \text{ S cm}^2 \text{ mol}^{-1}}$$

Q $\left(\lambda_m^\infty\right)_{Mg^{2+}} = x$. find $\left(\lambda_e^\infty\right)_{MgSO_4}$ ← equivalent conductivity

$\left(\lambda_m^\infty\right)_{SO_4^{2-}} = y$.

$\frac{\lambda_m^\infty}{\lambda_e^\infty} = \times$ factor

$E = \frac{M.wt.}{n\text{-factor}}$

$MgSO_4$

$\lambda_m^\infty = ?$

$\lambda_e^\infty = \checkmark$.

$\times = 2$

$\lambda_e^\infty = ?$

① $\Rightarrow \left(\lambda_m^\infty\right)_{MgSO_4} = \left(\lambda_m^\infty\right)_{Mg^{2+}} + \left(\lambda_m^\infty\right)_{SO_4^{2-}}$

③ $\Rightarrow \frac{\lambda_m^\infty}{\lambda_e^\infty} = ① \rightarrow 2$.

② $\Rightarrow \left(\lambda_m^\infty\right)_{MgSO_4} = x + y$

④ $\Rightarrow \boxed{\lambda_e^\infty = \frac{\lambda_m^\infty}{2}}$

$$\Lambda_e^\infty = \frac{\Lambda_m^\infty}{2}.$$

$$\boxed{\Lambda_e^\infty = \frac{x}{2} + \frac{y}{2}.} \quad \text{(formula)}.$$

Q $\left(\lambda_m^\infty\right)_{Ca^{2+}} = a$

$\left(\lambda_m^\infty\right)_{PO_4^{3-}} = b.$

$\left(\Lambda_e^\infty\right)_{Ca_3(PO_4)_2} = ?$

$3 \times (+2) \quad 2 \times (-3)$

$= +6 \quad = -6$

(X).

$$\boxed{\Lambda_e^\infty = \frac{\Lambda_m^\infty}{6}}$$

no. of cations

$Ca_3(PO_4)_2$

(3) Ca^{2+} (2) PO_4^{3-} → no. of anions.

(3) (2)

$\Lambda_m^\infty = \frac{\Lambda_m^\infty}{6} = \nu_\oplus(\lambda_m^\infty)_{Ca^{2+}} + \nu_\ominus(\lambda_m^\infty)_{PO_4^{3-}}$

$\nu_\oplus \to a$ $\quad \nu_\ominus \to b$

$$\boxed{\Lambda_e^\infty = \frac{3a + 2b}{6}}$$

9. $(\lambda_m^\infty)_{NH_4^+} = 200 \text{ S cm}^2 \text{ mol}^{-1}$

$(\lambda_m^\infty)_{Al^{3+}} = 300$ " " "

$(\lambda_m^\infty)_{SO_4^{2-}} = 125$ " " "

i) $(\lambda_e^\infty)_{Al^{3+}} = ?$ ii) $(\lambda_e^\infty)_{Al_2(SO_4)_3} = ?$ iii) $(\lambda_m^\infty)_{(NH_4)_2SO_4} = ?$

i) $(\lambda_e^\infty)_{Al^{3+}} = \frac{1}{3}$

ii) $100 + \frac{250}{2} = 100 + 125 = 225 \text{ S cm}^2 \text{ mol}^{-1}$

$$\left(\lambda_m^\infty\right)_{Al^{3+}} = 300.$$

$$\left(\lambda_m^\infty\right)_{SO_4^{2-}} = 125$$

$Al_2(SO_4)_3$

$$\frac{\Lambda_m^\infty}{6} = \frac{2\times 300 + 3\times 125}{6}$$

$$= \frac{600 + 375}{6.} = \frac{975}{6} = 162.5.$$

$S\,cm^2\,mol^{-1}$

$\alpha^2 C = K_a$.

$\alpha = \sqrt{\frac{K_a}{C}}$

$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$ or $\frac{\Lambda_m}{\Lambda_m^\infty}$

(M) 32.

$mol\,L^{-1} \equiv M$

iii) $(\Lambda_m^\circ) = 525\ S\,cm^2\,mol^{-1}$, $(NH_4)_2SO_4$.

Q The equivalent conductance of (M/32) soln of a weak monobasic acid at infinite dilution is 8.0 mho cm^2 and at infinite dilution is 400 mho cm^2. The Λ_e dissociat^n const. of this acid :—

(1) $\alpha = \frac{8}{400} = 2\times10^{-2}$

(2) $K_a = \frac{1}{32}\times(2\times10^{-2})^2$

$= \frac{1}{32}\times4\times10^{-4}$

$= 1.25\times10^{-5}$

a) 1.25×10^{-6} b) 6.25×10^{-4}

c) 1.25×10^{-4} d) 1.25×10^{-5}.

H/W:

redox rk:- Redox/11.

Q For the disproportionat:- of copper Eq:-

$2Cu^{+} \rightarrow Cu^{2+} + Cu^{0}$, E° is ?

(oxi: $Cu^{+} \rightarrow Cu^{2+}$; red: $Cu^{+} \rightarrow Cu^{0}$)

1 − 2 = 3

$E^{\circ} = E^{\circ}_{R} - E^{\circ}_{L}$

↓ ↓ given

$= 0.53 - (+0.15)$

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

$- Cu^{+} \rightarrow Cu^{0}$

$e^{-} \rightarrow - Cu^{+} + Cu^{0}$

a) 0.49V

$Cu^{+} + e^{-} \rightarrow Cu^{0}$

b) 0.38 V ✓

c) −0.19V

d) −0.38 V

(1) E° for $Cu^{2+}/Cu = 0.34$ V

$Cu^{2+} + 2e^{-} \rightarrow Cu^{0}$ (2)

$E^{\circ}_{1} = 0.34$ V

(2) E° for $Cu^{2+}/Cu^{+} = 0.15$ V (red)

(*) $Cu^{2+} + e^{-} \rightarrow Cu^{+}$

$E^{\circ}_{2} = 0.15$V

(**) $Cu^{+} + e^{-} \rightarrow Cu^{0}$

$E^{\circ}_{3} = ?$

0.53V

$\Delta G^{\circ}_{1} - \Delta G^{\circ}_{2} = \Delta G^{\circ}_{3}$

$\Delta G^{\circ}_{3} = -nFE^{\circ}_{3}$

$$\Delta G_3^\circ = \Delta G_1^\circ - \Delta G_2^\circ$$

$$-n_3 F E_0^3 = -n_1 F E_1^\circ - (+n_2 F E_2^\circ)$$

$n_3 = 1 \qquad n_1 = 2 \qquad n_2 = 1$

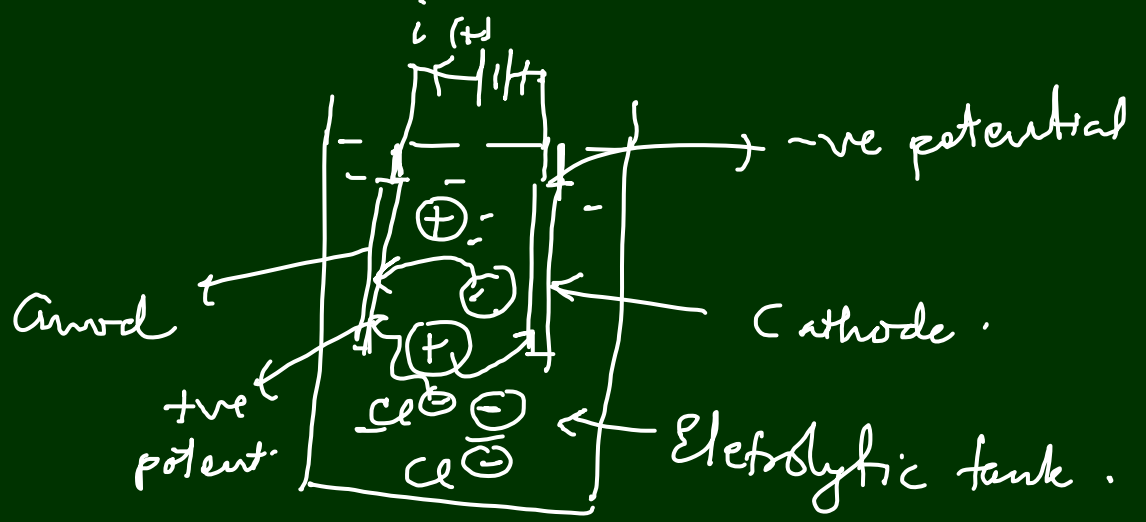
$$\boxed{E_0^3 = 2E_1^\circ - E_2^\circ}$$

$$\boxed{E_0^3} = 2 \times 0.34 - 0.15 = 0.53\,V$$

Ans.

Electrolysis.

$m = zit$.



Ionic conduct^{n}.

anodic pt.

$Cu^{2+}_{(aq)} + 2e^- \rightarrow Cu(s)$

(deposit^{n} on cathode)

$Cl_2(l) \rightarrow 2Cl^- + 2e^-$

(anode) gas is liberated at anode

~~cathodic pt~~

Applicatⁿs of electrolysis :-

- Impure metal (ore) → pure metal.
  (Mostly copper)
- Sodium | Magnesium also produced on a large scale

① Electrolysis of (molten) NaCl :—

$$NaCl \rightarrow Na^+ + Cl^-$$

At cathode (−) :- $Na^+ + e^- \rightarrow Na$ (reductⁿ)

" anode (+) :- $Cl^- + e^- \rightarrow Cl$ (oxidatⁿ)

$$Cl + Cl \rightarrow Cl_2$$

$$2NaCl \longrightarrow 2Na + Cl_2(g)$$

2. Electrolysis of aq. NaCl.

$NaCl \rightarrow Na^{+} + Cl^{-}$

$H_2O \rightarrow H^{+} + OH^{-}$

$Cl_2 \rightarrow$ anode.

H_2. $\rightarrow$ Cathode

Na. $\rightarrow$ Cathode

cathode (−) $\rightarrow$

$Na^{+} + e^{-} \rightarrow Na(s)$

$H^{+} + e^{-} \rightarrow \frac{1}{2} H_2 . (g)$

anode $\rightarrow$ $2H_2O \rightarrow O_2 + 4H^{+}(aq) + 4e^{-}$

$Cl^{-} \rightarrow \frac{1}{2} Cl_2(g) + e^{-}$

NaOH .

$NaCl(aq) + H_2O(l) \longrightarrow [Na^+(aq) + OH^\ominus(aq)]$

$+ \frac{1}{2} H_2(g) \quad + \frac{1}{2} Cl_2(g).$

Na^+, OH^-

Cathode . anode

Q aq. $CuSO_4$ soln → Electrolysis pdts :—

$Cu^{2+} + SO_4^{2-}$ — $CuSO_4 \rightarrow Cu^{2+} + SO_4^{2-}$

$H_2O \rightarrow H^+ + OH^-$

cathode — red^n : $Cu^{2+} + 2e^- \rightarrow Cu^0(s)$ [R]

anode — $2H_2O \rightarrow 4H^+ + O_2(\uparrow) + 4e$ [O]

$2Cu^{2+} + 2SO_4^{2-} + 2H_2O \rightarrow 2Cu(s) + 4H^+ + 4e^- + O_2 + 2SO_4^{2-}$

Electrolysis of $CuSO_4$ with copper electrode :-

$CuSO_4$ — Cu^{2+} + SO_4^{2-}

cathode

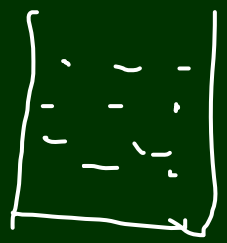
$Cu^{2+} + 2e^- \rightarrow Cu(s)$ deposit.

anode.

(ions are liberated)

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

ions are liberated.



Na^+ Mg^{2+} Ca^{2+}

Cu^{2+}