Chemistry Assignment-1

Slot : $H_2 + TH_2$

1- $Zn \mid Zn^{+2} \parallel Mg^{+2} \mid Mg(s)$

$Zn = -0.764\ V$

$Mg = -2.364\ V$

a) $Zn \longrightarrow Zn^{+2} + 2e^-$ = oxidation

$Mg^{+2} + 2e^- \longrightarrow Mg$ = reduction

$Mg + 2e^- \longrightarrow Mg \quad = -2.364$

$Zn \longrightarrow Zn^{+2} + 2e^- \quad = -0.764$

$Mg^{+2} + Zn \longrightarrow Mg + Zn^{+2}$ = cell reaction

b) $E^\circ_{cell} = E^\circ_{red} - E^\circ_{oxi}$

$E^\circ_{cell} = -2.364 - (-0.764)$

~~$E^\circ_{cell} = -2.364 -$~~

$\boxed{E^\circ_{cell} = -1.6\ V}$

$\Delta G^\circ = -nFE^\circ_{cell}$

$= -2 \times 96.5 \times 1.6\ V$

~~$= -2 \times 9$~~

$= 308.8\ kJ/mol$ x x x n

$$E_{cell} = E^{\circ}_{cell} - \frac{0.0592}{n} \log \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

$$= -1.6 - \frac{0.0592}{2} \log \frac{[Zn^{+2}]}{[Mg^{+2}]}$$

$$= -1.6 - \frac{0.0592}{2} \log \left(\frac{10^{-4}}{10^{-3}} \right)$$

$$= -1.6 + \frac{0.0592}{2}$$

$$\boxed{E_{cell} = -1.5704\,V}$$

$$\Delta G = \Delta G^{\circ} + RT \ln Q$$

$$= 308.8 + 8.314\ J/mol \times 298\ K \times \ln(10^{-1})$$

$$\Delta G = -2168.7 \times 10^{-3}\ J\,mol^{-2}$$

E_{cell} is not greater than zero. So, cell reaction is not spontaneous.

2) $E_{cell} = \frac{0.0592}{n} \log\left(\frac{0.123}{0.00162}\right)$

$0.02571 = \frac{0.0592}{n} \log(75.9)$

$= \frac{0.0592}{n} \times 1.88$

$n = \frac{0.0592}{0.02571} \times 1.88$

$\boxed{n = 4.32}$

(3) a) Given $i = 4.75\,A$

$w = 1.50\,g$ of Cu

no. of moles of Cu $= \frac{w}{G.mwt} = \frac{1.50}{63.54}$

$\boxed{n = 0.0236 \text{ moles}}$

No. of Cu ions $= \frac{6.023 \times 10^{23} \times 1.50}{63.546}$

$= \frac{9.03 \times 10^{23}}{63.546}$

$\boxed{\text{No. of ions} = 1.423 \times 10^{22} \text{ ions}}$

charge of $1e^- = 1.60 \times 10^{-19}$ C

No. of electrons $= \frac{2 \times 9.03 \times 10^{23}}{63.546}$

$= \frac{1.806 \times 10^{24}}{63.546}$

$= 0.28$ electrons

Total charge $= 288,960 \div 63.546$

$= \frac{1.60 \times 10^{-19} \times 1.806 \times 10^{24}}{63.546}$

$= 4574$ C

$\Rightarrow 4.75 \times t = 288960 \div 63.546$

$t = \frac{288960}{301.8485}$

$\boxed{t = 957 \text{ seconds}}$

1 sec $\longrightarrow$ 0.0167 min

967 $\longrightarrow$ x

$\boxed{t = 15.9819 \text{ mins}}$