

Page No. Important Questions numerical :

M-3:

Q2.

Cell representation: $\text{Ag(s)} | \text{AgNO}_3 \underset{C_1 = (0.05 \text{ M})}{||} \text{AgNO}_3 \underset{(1 \text{ M}) = C_2}{|} \text{Ag(s)}$

At anode, $\text{Ag} \rightarrow \text{Ag}^+ + 1e^-$

At cathode, $\text{Ag}^+ + 1e^- \rightarrow \text{Ag}$

Net cell reaction, $\text{Ag} + \text{Ag}^+ \rightarrow \text{Ag}^+ + \text{Ag}$

$$E_{\text{cell}} = \frac{0.0591}{n} \log \left[\frac{C_1}{C_2} \right] \quad (\because n=1)$$

$$= 0.0591 \log 20$$

$$= 0.0591 \times 1.301$$

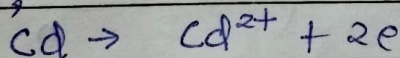
$$E_{\text{cell}} = 0.0769 \text{ V}$$

Q3. Cell representation:

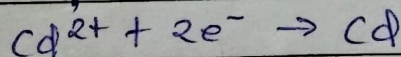
$\text{Cd} | \text{CdSO}_4 \underset{C_1}{(0.0093 \text{ M})} || \text{CdSO}_4 \underset{C_2}{(x \text{ M})} | \text{Cd}$

→ cell reaction,

At Anode,



At cathode,



Net reaction, $\text{Cd} + \text{Cd}^{2+} \rightarrow \text{Cd}^{2+} + \text{Cd}$

$\therefore n=2$ & $E_{\text{cell}} = 0.03 \text{ V}$ (given)

$$\Rightarrow E_{\text{cell}} = \frac{0.0591}{2} \log \left[\frac{x}{0.0093} \right] \quad \left(\because E_{\text{cell}} = \frac{0.0591}{n} \log \left[\frac{C_2}{C_1} \right] \right)$$

$$0.03 = \frac{0.0591}{2} \log \left[\frac{x}{0.0093} \right]$$

$$\log \left[\frac{x}{0.0093} \right] = \frac{0.03 \times 2}{0.0591}$$

$$\log \left[\frac{x}{0.0093} \right] = 1.0152$$

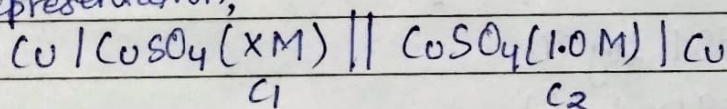
$$\frac{x}{0.0093} = \text{anti log} [1.0152]$$

$$\frac{x}{0.0093} = 10.35$$

$$x = 10.35 \times 0.0093$$

$$x = 0.096255$$

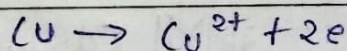
Q4. → Cell representation,



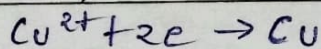
$$\rightarrow E_{\text{cell}} = 0.0295\text{V}$$

→ Cell reaction,

At anode,



At cathode,



$$\rightarrow E_{\text{cell}} = \frac{0.0591}{2} \log \left[\frac{1}{x} \right]$$

$$n=2 \quad \left(\because E_{\text{cell}} = \frac{0.0591}{n} \log \left[\frac{C_2}{C_1} \right] \right)$$

$$0.0295 = \frac{0.0591}{2} \log \left(\frac{1}{x} \right)$$

$$\log \frac{1}{x} = \frac{0.0295 \times 2}{0.0591}$$

$$\log \frac{1}{x} = 0.9983$$

$$\frac{1}{x} = \text{antilog} [0.9983]$$

$$\Rightarrow \frac{1}{x} = 9.961$$

$$x = \frac{1}{9.961}$$

$$x = 0.1004$$

Q9.

$$CPR = \frac{K \cdot W}{P \cdot A \cdot T}$$

Where, K = CPR constant W = weight of metal lost P = density of the metal A = Surface area of corrosion T = Time taken at which corrosion take place.

	Given	In mpy	In mmpy
K		534	87.6
W	485g	485×10^3	485×10^3
P	7.9 g/cm^3	7.9	7.9
A	100 inch^2	100 inch^2	$(6.45 \times 100) \text{ cm}^2$
T	1y	365×24	365×24

~~Time =~~

$$1 \text{ kg} = 10^6 \text{ mg}$$

$$1 \text{ g} = 10^3 \text{ mg}$$

$$1 \text{ inch}^2 = 6.45 \text{ cm}^2$$

$$1 \text{ cm}^2 = 0.155 \text{ inch}^2$$

$$CPR (\text{in mpy}) = \frac{K \cdot W}{P \cdot A \cdot T}$$

$$= \frac{534 \times 485 \times 10^3}{7.9 \times 100 \times 365 \times 24}$$

$$= 37.4 \text{ in mpy}$$

$$CPR (\text{in mmpy}) = \frac{K \cdot W}{P \cdot A \cdot T}$$

$$= \frac{87.6 \times 485 \times 10^3}{7.9 \times 6.45 \times 100 \times 365 \times 24}$$

$$= 0.9518 \text{ in mmpy}$$

Q10)

$$CPR = \frac{K \cdot W}{P \cdot A \cdot T}$$

In mpy

	Given	In mpy
K		534
W	1.2 Kg	1.2×10^6
P	7.87 g/cm ³	7.87
A	20 inch ²	20 inch ²
T	?	?
CPR	400 mpy	400 mpy

$$400 = \frac{534 \times 1.2 \times 10^6}{7.87 \times 20 \times T}$$

$$T = \frac{534 \times 1.2 \times 10^6}{7.87 \times 20 \times 400}$$

$$T = 10177.8907 \text{ hours}$$

$$T = 1.162 \text{ years}$$

Q11)

$$\text{In mpy, } CPR = \frac{K \cdot W}{P \cdot A \cdot T}$$

P. A. T

	Given	In mpy	In mpy
K		534	87.6
W	525 g	525×10^3	525×10^3
P	7.9 g/cm ³	7.9	7.9
A	120 inch ²	120 inch ²	120×6.45
T	1 year	365×24	365×24

$$= \frac{534 \times 525 \times 10^3}{7.9 \times 120 \times 365 \times 24}$$

$$= 33.76 \text{ mpy (approx)}$$

$$CPR (\text{in mpy}) = \frac{87.6 \times 525 \times 10^3}{7.9 \times 120 \times 6.45 \times 365 \times 24}$$

$$= 0.8586 \text{ mpy}$$

Q12)

$$\text{In mpy, } CPR = \frac{K \cdot W}{P \cdot A \cdot T}$$

	Given	In mpy
K		534
W	2.5 Kg	2.5×10^6
P	7.87 g/cm ³	7.87
A	35 inch ²	35 inch ²
T	?	?
CPR	500 mpy	500

$$500 = \frac{534 \times 2.5 \times 10^6}{7.87 \times 35 \times T}$$

$$7.87 \times 35 \times T$$

$$T = \frac{534 \times 2.5 \times 10^6}{7.87 \times 35 \times 500}$$

$$7.87 \times 35 \times 500$$

$$T = 9693.23 \text{ hours}$$

$$T = 1.1065 \text{ year}$$

Module 4:

Q1. Given,

$$N_1 = 10$$

$$N_2 = 20$$

$$N_3 = 30$$

$$N_4 = 40$$

$$M_1 = 100$$

$$M_2 = 200$$

$$M_3 = 300$$

$$M_4 = 400$$

$$\bar{M}_h = \frac{\sum N_k M_k}{N_k}$$

$$= \frac{N_1 M_1 + N_2 M_2 + N_3 M_3 + N_4 M_4}{N_1 + N_2 + N_3 + N_4}$$

$$= \frac{(10 \times 100) + (20 \times 200) + (30 \times 300) + (40 \times 400)}{10 + 20 + 30 + 40}$$

$$= \frac{1000 + 4000 + 9000 + 16000}{100}$$

$$= \frac{30000}{100}$$

$$= 300$$

$$\bar{M}_w = \frac{\sum N_k (M_k)^2}{N_k M_k}$$

$$= \frac{(10 \times 100^2) + (20 \times 200^2) + (30 \times 300^2) + (40 \times 400^2)}{30000}$$

$$= \frac{10000000}{30000}$$

$$= \frac{1000}{3}$$

$$= 333.33$$

Q2.) Given,

$$N_1 = 100$$

$$N_2 = 200$$

$$N_3 = 300$$

$$N_4 = 400$$

$$M_1 = 1000$$

$$M_2 = 2000$$

$$M_3 = 3000$$

$$M_4 = 4000$$

$$\bar{M}_n = \frac{\sum N_k M_k}{N_k}$$

$$= \frac{(100 \times 1000) + (200 \times 2000) + (300 \times 3000) + (400 \times 4000)}{100 + 200 + 300 + 400}$$

$$= \frac{100000 + 400000 + 900000 + 1600000}{1000}$$

$$= \frac{3000000}{1000}$$

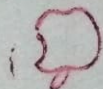
$$= 3000$$

$$\bar{M}_w = \frac{\sum N_k (M_k)^2}{N_k M_k}$$

$$= \frac{(100 \times 1000^2) + (200 \times 2000^2) + (300 \times 3000^2) + (400 \times 4000^2)}{3,000,000}$$

$$= 3333.33$$

$$PDI = \frac{\bar{M}_w}{\bar{M}_n} = \frac{3333.33}{3000} = 1.11$$



Q3. Given,

$$N_1 = 100$$

$$M_1 = 15000$$

$$N_2 = 200$$

$$M_2 = 20000$$

$$N_3 = 300$$

$$M_3 = 25000$$

$$\bar{M}_n = \frac{\sum N_k M_k}{N_k}$$

$$= \frac{(100 \times 15000) + (200 \times 20000) + (300 \times 25000)}{100 + 200 + 300}$$

$$= \frac{1500000 + 4000000 + 7500000}{600}$$

$$= \frac{13000000}{600}$$

$$= 21666.667$$

$$\bar{M}_w = \frac{\sum N_k M_k^2}{\sum N_k M_k}$$

$$= \frac{(100 \times 15000^2) + (200 \times 20000^2) + (300 \times 25000^2)}{13000000}$$

$$= \frac{2.9 \times 10^{11}}{13 \times 10^6}$$

$$= 22307.69$$

$$PDI = \frac{\bar{M}_w}{\bar{M}_n} = \frac{22307.69}{21666.667} \approx 1.0295 \approx 1.03$$