

Task 1

$$a) R = \frac{V}{I}$$

$$R_E = \frac{V_E}{I_E}$$

$$E = 0.6 \text{ V}$$

$$I_E = I_H \text{ (Parallel)}$$

$$H = 0.7 \text{ V}$$

$$I_A = 0.5 \text{ A}$$

$$\therefore R_E = \frac{0.6}{0.5} = \underline{\underline{1.2 \Omega}}$$

$$R_H = \frac{0.7}{0.5} = \underline{\underline{1.4 \Omega}}$$

b) A is in parallel to B and C.

$$\therefore \text{Current passing through } B = \underline{\underline{0.5 \text{ A}}}$$

$$\text{Current passing through } A = \underline{\underline{0.5 \text{ A}}}$$

c) i) $E = 1.25 \text{ J}$ per second

$$P = \frac{V^2}{R}$$

$$P = I^2 R$$

$$R = \frac{P}{I^2} \Rightarrow \frac{1.25}{(0.5)^2} = 5 \Omega$$

$$\therefore \text{Resistance in A } (R_A) = \underline{\underline{5 \Omega}}$$

ii) $R_A = R_B = R_C$ [Since they are in parallel]

$$\therefore \text{Resistance in B } (R_B) = 5 \Omega$$

$$\text{Resistance in C } (R_C) = 5 \Omega$$

$$\text{iii) } V = IR \Rightarrow V_A = I_A R_A$$

$$V_A = (0.5)(5) = \underline{\underline{2.5 \text{ V}}}$$

Potential difference across A = 2.5 V

$\Rightarrow$ Potential difference across B and C is 2.5 V

iv) Potential difference across L to M = 6V
 $\therefore$ Potential difference across D = 6V

$$I = 0.5 \text{ A}$$

$$R_D = \frac{V}{I} = \frac{6 \text{ V}}{0.5 \text{ A}} = 12 \Omega$$

$\therefore$ Resistance for D = 12 Ω

d) $V_{\text{lost}} = 2 \text{ V}$

$$R = 6 \Omega$$

$$I_{\text{total}} = \frac{6 \text{ V}}{6 \Omega} = \underline{1 \text{ A}}$$

$$\therefore \text{Current through 1 cell} = \frac{1 \text{ A}}{4} = \underline{0.25 \text{ A}}$$

$\Rightarrow$ internal resistance, $V = Ir$

$$2 \text{ V} = 0.25 \text{ A } r$$

$$r = \frac{2 \text{ V}}{0.25 \text{ A}} = \underline{8 \Omega}$$

total resistance in parallel (R_{total}) $\Rightarrow$

$$\frac{1}{R_{\text{total}}} = \frac{1}{r} + \frac{1}{r} + \frac{1}{r} + \frac{1}{r}$$

$$\frac{1}{R} = \frac{4}{8 \Omega} \Rightarrow R = \frac{8 \Omega}{4}$$

$$R_{\text{total}} = \underline{2 \Omega}$$

$$\therefore \text{internal resistance} = \underline{8 \Omega}$$

$$\text{total resistance} = \underline{2 \Omega}$$

e) resistance in $F = 6 \Omega$

Using Ohm's law $\rightarrow$ voltage drop $\Rightarrow$

$$V = IR$$

$$V_F = (0.25A)(6 \Omega) = 1.5V$$

$$V_F = \underline{\underline{1.5V}}$$

f) Internal resistance $= 8 \Omega$

Total resistance $= 2 \Omega$

Resistance (F) $= 6 \Omega$

~~Resistance $= 8 \Omega$~~

$$\frac{1}{R_{EQH}} = \frac{1}{R_{EQ}} + \frac{1}{R_H}$$

$$R_{total} = R_{EQH} + 6 \Omega + 2 \Omega$$

$$R_{total} = \left(\frac{1}{0.6} + \frac{1}{0.7} \right)^{-1} + 6 + 2$$

$$R_{total} = (1.667 + 1.429)^{-1} + 6 + 2$$

$$= 0.323 + 6 + 2$$

$$R_{total} = \underline{\underline{8.323 \Omega}}$$

g) $E_{total} = 4 \cdot E$

$$E_{total} = V_{lost} + Ir$$

$$\Rightarrow 6V = 2V + (1A)(8\Omega)$$

emf for 1 cell $\Rightarrow$

$$E = \frac{6V - 2V}{1A}$$

$$E = 4V$$

$\therefore$ emf of each cell $= \underline{\underline{4V}}$