DPP – 4

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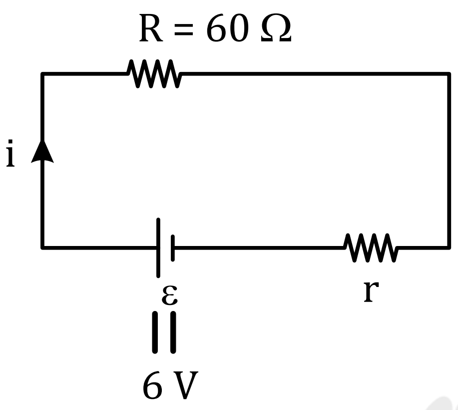
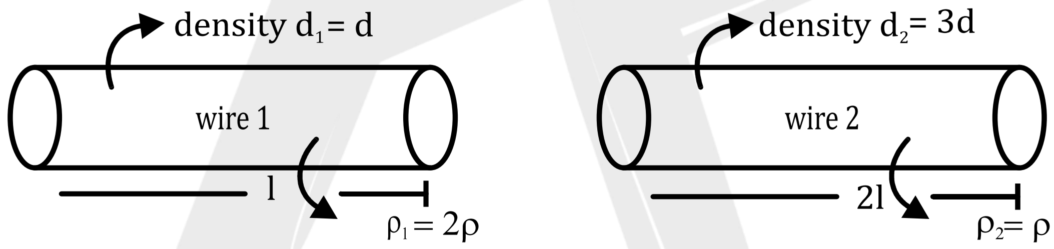
1. 

$$P = \frac{E^2}{R + r}$$

$$i = \frac{E}{R + r}$$

$$\Rightarrow 0.4 = \frac{6^2}{60 + r}$$

$$r = 30\Omega$$

2. 

First resistance of wire 1

mass of wire 1 = mass of wire 2

$$R_1 = \frac{2\rho(e)}{A_1}$$

$$d.\ A_1 \times l = 3d \cdot A_2 \times 2l$$

$$A_1 = 6A_2$$

$$P_1 = \frac{V^2}{R_1} = \frac{v^2}{\frac{2\rho l}{A_1}} = \frac{V^2 A_1}{2\rho l} = 10\ W$$

$$P_2 = \frac{V^2}{R_2} = \frac{V^2}{\frac{\rho(2l)}{A_2}} = \frac{V^2 A_2}{2\rho l} = \frac{V^2 A_1}{6 \times 2\rho l} = \frac{10}{6}$$

$$P_2 = \frac{5}{3}\ \text{watt.}$$

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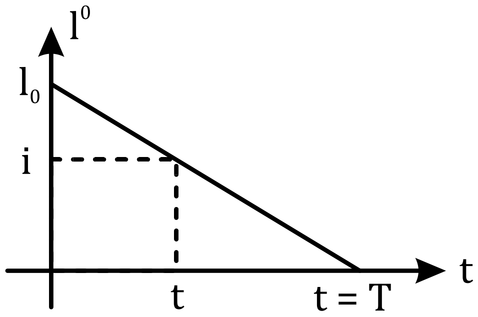
3. 

$$q = \frac{1}{2} \times i_0 T = \frac{i_0 T}{2}$$

$$i_0 = \frac{22}{T}$$

$$L = 1_0 - \frac{L_0}{T} t$$

$$L = \frac{2q}{T}\left(1 - \frac{t}{T}\right)$$

heat produced from 0 to T is given as

$$H = \int_0^T L^2 R dt \Rightarrow \text{Aster Solving}$$

$$H = \frac{4}{3} \frac{q^2 R}{T}$$

4. marked rating 220 V, 100 W

$$i = \frac{V}{R} = \frac{220}{R} = \frac{220}{\frac{220 \times 220}{100}}$$

$$R = \frac{V^2}{P} = \frac{220 \times 220}{100}$$

$$i = \frac{100}{220} = \frac{10}{22} = \frac{5}{11} \text{ Amp}$$

5. $\left.\begin{array}{l} 500\text{ W} \\ V = 200\text{ volt} \end{array}\right] \Rightarrow \text{rating}$

$$R = \frac{V^2}{p} = \frac{200 \times 200}{500} = 80\Omega$$

$$H = \frac{V_{real}^2}{R} t = \frac{160 \times 160}{80} \times 20 \times 60$$

$$= 2 \times 160 \times 1200$$

$$= 24000 \times 16$$

$$H = 384\text{ KJ}.$$

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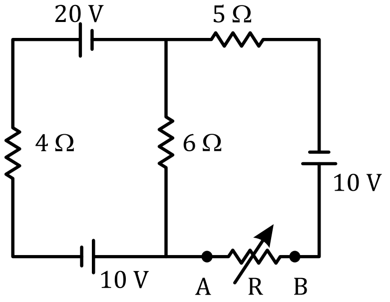
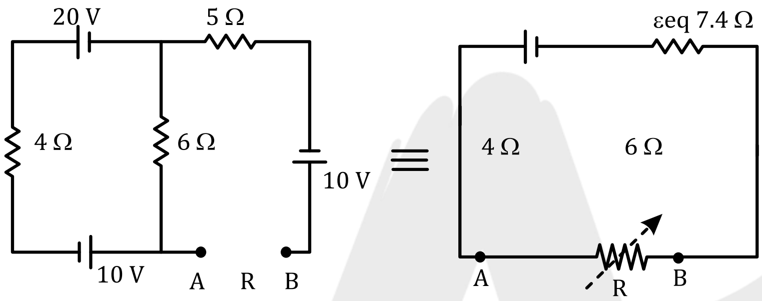
6.



⇒ first we find internal resistance Across A & B

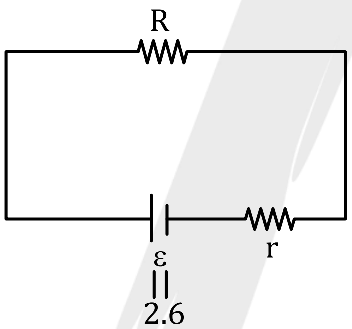


R = 7.4 Ω

7. I = 1Amp

V = 2.0Volt

E = 2.6 V



$i = \dfrac{2 \cdot 6}{R + r}$

$1 = \dfrac{2 \cdot 6}{R + r} \Rightarrow r + R = 2 \cdot 6$

$\varepsilon - ir = 2$

$2 \cdot 6 - r = 2$

$\pi = 0.6\Omega$

$R = 2\pi$

P battery $= 1^2 r = 1^2 \times 0.6 = 0.6$ W

& $P_R = L^2 \times R = 1 \times 2 = 2W$

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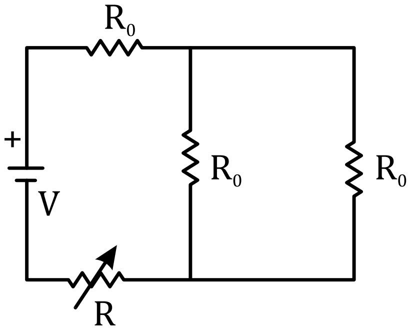
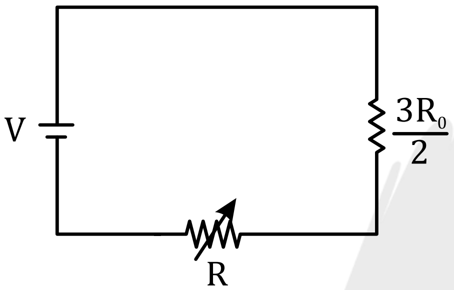
8.





$R = \frac{3R_0}{2}$ For maximum Power dissipation

9. heat generated f transferred to surranding is always proportional to the exposed area.

$Q \propto A$

consider l & r are filament length & radius

$A = 2\pi rl$

So $P = \frac{V^2}{R} = k \cdot 2\pi rl$

At steady state

$$R = \frac{\rho l}{A} = \frac{\rho l}{\pi r^2} = \frac{\rho l}{\frac{\pi D^2}{4}}$$

$$R = \frac{4\rho l}{\pi R^2}$$

$$\Rightarrow \frac{V^2}{R} = P \Rightarrow V^2 = \frac{4k\rho l^2}{D}$$

$$\Rightarrow \ln (V)^2 = \ln \frac{4k\rho l^2}{D}$$

$$\Rightarrow \text{ diff both side } \Rightarrow \frac{2dD}{V} = -\frac{dD}{D} \; n\% = -2\%$$