DPP-1

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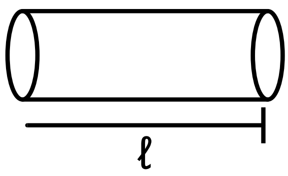
1.



Initial $R_i = R_1 = \frac{\rho l}{A}$

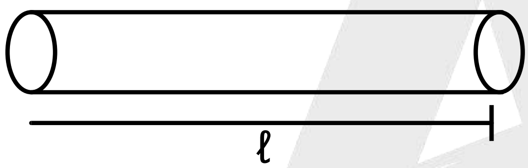
Initial volume $=$ Al

finally length is increased by twice of its original length

$l_f = l + 2l = 3l$

final volume $= A_f \cdot 3l =$ Initial volume.

$A_f \cdot 3l = Al$

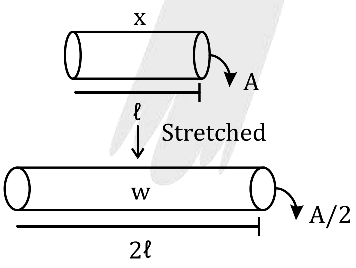


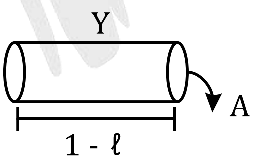
$A_f = A/3$

$R_f = \frac{\rho(3\ell)}{A/3} = \frac{9\rho l}{A} = 9R_i$

$\frac{R_f}{R_i} = 9:1$

2. ʻ $x + y = 1m$





$R_w = \frac{\rho 2\ell}{A/2} = \frac{4\rho\ell}{A}$

$R_\gamma = \frac{\rho(1-\ell)}{A}$

$R_w = 2R\gamma$

$\frac{4\rho\ell}{\cancel{A}} = \frac{2\rho(1-\ell)}{\cancel{A}}$

$2\ell = 1 - \ell$

$\ell_x = \frac{1}{3}$ $\qquad$ $\ell_2 = {}^{2}\!/_{3}$

$\ell x : \ell\gamma = 1:2$

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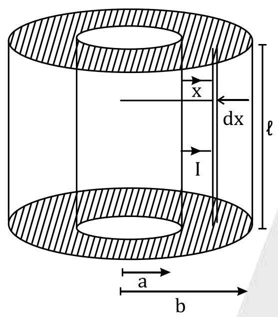
3. 

$$R = \frac{\rho\ell}{A}$$

$$R = \frac{\rho\ell^2}{A\ell} = \frac{\rho\ell^2}{\text{volume}(A\ell)}$$

$$\frac{\Delta R}{R}\times 100 = \frac{2\Delta\ell}{\ell}\times 100$$

$$\frac{\Delta R}{R}\times 100 = 0.8\% \qquad [\text{volume = constant}]$$

4. 

For max joule heating

R is minimum

$R = \frac{\rho\ell}{A}$ For R min A is max

$$dR = \frac{\rho dx}{2\pi\ell x}$$

$$R = \frac{\rho}{2\pi\ell}\int_a^b dx$$

$$R = \frac{\rho}{2\pi\ell}$$

$$\ell x\left(\frac{b}{a}\right)$$

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5. Let length of wire = ℓ . 4 Area of cross section = A $R = \frac{\rho\ell}{A}$

Cut into four port each resistance $R^1 = \frac{\rho\ell}{4A} = \frac{R}{4}$ connect is parallel

$$\frac{1}{R_{eq}} = \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4} + \frac{1}{R/4}$$

$$\frac{1}{R_{eq}} = \frac{4}{R} \times 4 = \frac{16}{R}$$

$$R_{eq} = \frac{R}{16} = \frac{80}{16} = 5\Omega$$

Statement – I – Correct

6. (a) $J = J_0\left(1 - \frac{r}{R}\right)$

$$i = \int J.dA = J_0 \int_0^R \left(1 - \frac{r}{R}\right) 2\pi r dr$$

$$i = J_0 2\pi \left[\frac{r^2}{2} - \frac{r^3}{3R}\right]_0^R$$

$$= 2\pi J_0 \left[\frac{R^2}{2} - \frac{R^3}{3R}\right]_0^R$$

$$= 2\pi J_0 \left[\frac{R^2}{2} - \frac{R^3}{3R}\right] = \frac{\pi J_0 R^2}{3}$$

$$= \frac{J_0 A}{3}$$

(b) $i = \int J \quad dA = \int_0^R J_0 \frac{r}{R} 2\pi r dr$

$$i = \frac{2\pi J_0}{R} \int_0^R r^2 dr$$

$$i = \frac{2\pi J_0}{R}\left[\frac{R^3}{3}\right]$$

$$= \frac{2\pi J_0 R^2}{3} = \frac{2J_0 A}{3}$$

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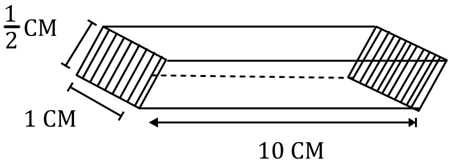
7.



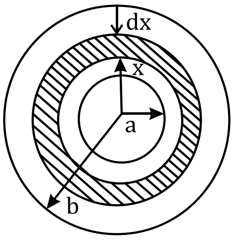
$$R = \frac{\rho \ell}{A}$$

For $R_{max} \to \ell_{max}$

$A \to$ minimum

Option – A

8.

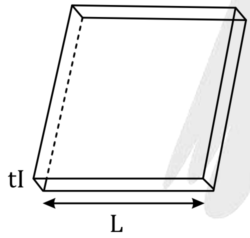


$$dR = \frac{\rho dx}{2\pi x t}$$

$$R = \frac{\rho}{2\pi t}\int_a^b \frac{dx}{x}$$

$$= \frac{\rho}{2\pi\tau} \ \ell n\left(\frac{b}{a}\right)$$

9.



$$R = \frac{\rho L}{Lt} = \frac{\rho}{t}$$

Option (c)

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10. $\rho_{A\ell} = 2.7 \times 10^{-8} \Omega - m$

$\rho_{Fe} = 1.0 \times 10^{-7} \Omega - m$

$\ell = 50mm = 5 \times 10^{-2} m$

$A_{A\ell} = 4 \times 10^{-6} m^2$

$A_{Fe} = 45 \times 10^{-6} m^2$

$$R_{A\ell} = \frac{\rho\ell}{A_{Al}} = \frac{2.7 \times 10^{-8} \times 5 \times 10^{-2}}{4 \times 10^{-6}}$$

$R_{Al} = 2.7 \times 1.25 \times 10^{-4} \Omega$

$$R_{Fe} = \frac{1.0 \times 10^{-7} \times 5 \times 10^{-2}}{45 \times 10^{-6}}$$

$$= \frac{1}{9} \times 10^{-3} \Omega$$

$$\frac{1}{E_{eq}} = \frac{1}{R_{Al}} + \frac{1}{R_{Fe}}$$

$$R_{eq} = \frac{1875}{49} H\Omega$$