

Q. 04 Two conductors are made of the same material and have the same length. Conductor A is a solid wire of diameter 1 mm. Conductor B is a hollow tube of outer diameter 2 mm and inner diameter 1 mm. Find the ratio of resistance R_A to R_B .

Solution:

Key concept: We know that the resistance of wire is $R = \rho \frac{l}{A}$

where A is cross-sectional area of conductor, ρ is the specific resistance or resistivity and L is the length of conductor.

The resistance of first conductor

$$R_A = \frac{\rho l}{\pi (10^{-3} \times 0.5)^2}$$

The resistance of second conductor,

$$R_B = \frac{\rho l}{\pi [(10^{-3})^2 - (0.5 \times 10^{-3})^2]}$$

Now, the ratio of two resistors is given by

$$\frac{R_A}{R_B} = \frac{(10^{-3})^2 - (0.5 \times 10^{-3})^2}{(0.5 \times 10^{-3})^2} = 3:1$$