

Answer on Question #46721, Physics, Other

Question:

Two wires P and Q, each of the same length and same material, are connected in parallel to a battery. The diameter of P is half that of Q. What fraction of the total current passes through P?

0.2

0.25

0.33

0.5

Answer:

The resistance R of a conductor of uniform cross section, therefore, can be computed as

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

where l is the length of the conductor, A is the cross-section area of the conductor, and ρ (rho) is the electrical resistivity.

Therefore:

$$R_P = \frac{\rho l}{\pi d_P^2/4}$$

$$R_Q = \frac{\rho l}{\pi d_Q^2/4}$$

Or:

$$\frac{R_P}{R_Q} = \frac{d_Q^2}{d_P^2} = 4$$

Voltage on P equals voltage on Q:

$$V_P = V_Q = V$$

Current equals:

$$I_P = \frac{U}{R_P}$$

$$I_Q = \frac{U}{R_Q} = \frac{4U}{R_P} = 4I_P$$

Total current:

$$I_t = I_P + I_Q = 5I_P$$

Fraction equals:

$$\frac{I_P}{I_t} = \frac{I_P}{5I_P} = \frac{1}{5}$$

Answer: 0.2