A rectangular block of iron has a diameter 1.2cm x 1.2cm x 15cm
i) What is the resistance of the opposing square ends?
ii) what is the resistance between two of the rectangular faces?
(The resistivity for iron at room temperature = 9.6 x 10-8 Ω.m)

Solution.

Resistance is:

$$R = \rho \frac{l}{S};$$

where $\rho = 9.6 \cdot 10^{-8}$ Ω/m is the iron resistivity;

l is the length of rectangular block, m;

S is the cross-sectional area of rectangular block, m²;

    I. For the first case cross-sectional area of rectangular block is square:

$$S = 1.2 \times 1.2 \; cm^2 = 1.44 \cdot 10^{-4} \; m^2;$$

and the length of rectangular block is:

$$l = 15cm = 0.15m$$

Find the resistance of the opposing square ends:

$$R = 9.6 \cdot 10^{-8} \frac{0.15}{1.44 \cdot 10^{-4}} = 1 \cdot 10^{-4} \; \Omega$$

    II. For the second case cross-sectional area of rectangular block is rectangular:
$$S = 1.2 \times 15 \; cm^2 = 1.8 \cdot 10^{-3} \; m^2;$$

and the length of rectangular block is:

$$l = 1.2cm = 0.012 \; m$$

Find the resistance between two of the rectangular faces:
$$R = 9.6 \cdot 10^{-8} \frac{0.012}{1.8 \cdot 10^{-3}} = 6.4 \cdot 10^{-7} \; \Omega$$

Answer: I. the resistance of the opposing square ends is $\mathbf{1 \cdot 10^{-4}}$ **Ω; II.** the resistance between two of the rectangular faces is $\mathbf{6.4 \cdot 10^{-7}}$ **Ω.**