

17. The resistance of the coil is given by $R = \rho L/A$, where L is the length of the wire, ρ is the resistivity of copper, and A is the cross-sectional area of the wire. Since each turn of wire has length $2\pi r$, where r is the radius of the coil, then $L = (250)2\pi r = (250)(2\pi)(0.12 \text{ m}) = 188.5 \text{ m}$. If r_w is the radius of the wire itself, then its cross-sectional area is $A = \pi r_w^2 = \pi(0.65 \times 10^{-3} \text{ m})^2 = 1.33 \times 10^{-6} \text{ m}^2$. According to Table 27-1, the resistivity of copper is $1.69 \times 10^{-8} \Omega \cdot \text{m}$. Thus,

$$R = \frac{\rho L}{A} = \frac{(1.69 \times 10^{-8} \Omega \cdot \text{m})(188.5 \text{ m})}{1.33 \times 10^{-6} \text{ m}^2} = 2.4 \Omega .$$