8. A small but measurable current of \(1.2 \times 10^{-10}\) A exists in a copper wire whose diameter is 2.5 mm. The number of charge carriers per unit volume is \(8.49 \times 10^{28}\) m\(^{-3}\). Assuming the current is uniform, calculate the (a) current density and (b) electron drift speed.

19. **SSM** What is the resistivity of a wire of 1.0 mm diameter, 2.0 m length, and 50 m\(\Omega\) resistance?

43. **ILW** An unknown resistor is connected between the terminals of a 3.00 V battery. Energy is dissipated in the resistor at the rate of 0.540 W. The same resistor is then connected between the terminals of a 1.50 V battery. At what rate is energy now dissipated?

93. Thermal energy is to be generated in a 0.10 \(\Omega\) resistor at the rate of 10 W by connecting the resistor to a battery whose emf is 1.5 V. (a) What potential difference must exist across the resistor? (b) What must be the internal resistance of the battery?

2. In Fig. 27-26, the ideal batteries have emfs \(\mathcal{E}_1 = 150\) V and \(\mathcal{E}_2 = 50\) V and the resistances are \(R_1 = 3.0\) \(\Omega\) and \(R_2 = 2.0\) \(\Omega\). If the potential at \(P\) is 100 V, what is it at \(Q\)?

86. Two resistors \(R_1\) and \(R_2\) may be connected either in series or in parallel across an ideal battery with emf \(\mathcal{E}\). We desire the rate of energy dissipation of the parallel combination to be five times that of the series combination. If \(R_1 = 100\) \(\Omega\), what are the (a) smaller and (b) larger of the two values of \(R_2\) that result in that dissipation rate?
In Fig. 27-73, \( R_1 = 5.00 \, \Omega \), \( R_2 = 10.0 \, \Omega \), \( R_3 = 15.0 \, \Omega \), \( C_1 = 5.00 \, \mu F \), \( C_2 = 10.0 \, \mu F \), and the ideal battery has emf \( \varepsilon = 20.0 \, \text{V} \). Assuming that the circuit is in the steady state, what is the total energy stored in the two capacitors?