

CHAPTER 18: Electric Currents

Problems

18–2 and 18–3 Electric Current, Resistance, Ohm's Law

(Note: The charge on one electron is $1.60 \times 10^{-19} \text{ C}$).

- (I) What is the resistance of a toaster if 120 V produces a current of 4.2 A?
- (II) A hair dryer draws 7.5 A when plugged into a 120-V line. (a) What is its resistance? (b) How much charge passes through it in 15 min? (Assume direct current.)
- (II) An electric clothes dryer has a heating element with a resistance of 9.6Ω . (a) What is the current in the element when it is connected to 240 V? (b) How much charge passes through the element in 50 min?
- (II) A bird stands on a dc electric transmission line carrying 2800 A (Fig. 18–34). The line has $2.5 \times 10^{-5} \Omega$ resistance per meter, and the bird's feet are 4.0 cm apart. What is the potential difference between the bird's feet?

18–4 Resistivity

- (I) What is the diameter of a 1.00-m length of tungsten wire whose resistance is 0.32Ω ?
- (I) What is the resistance of a 3.5-m length of copper wire 1.5 mm in diameter?
- (II) Can a 2.5-mm-diameter copper wire have the same resistance as a tungsten wire of the same length? Give numerical details.
- (II) Compute the voltage drop along a 26-m length of household no. 14 copper wire (used in 15-A circuits). The wire has diameter 1.628 mm and carries a 12-A current.

18–5 and 18–6 Electric Power

- (I) What is the maximum power consumption of a 3.0-V portable CD player that draws a maximum of 320 mA of current?
- (I) (a) Determine the resistance of, and current through, a 75-W lightbulb connected to its proper source voltage of 120 V. (b) Repeat for a 440-W bulb.

31. (II) A 120-V hair dryer has two settings: 850 W and 1250 W. (a) At which setting do you expect the resistance to be higher? After making a guess, determine the resistance at (b) the lower setting; and (c) the higher setting.
32. (II) You buy a 75-W lightbulb in Europe, where electricity is delivered to homes at 240 V. If you use the lightbulb in the United States at 120 V (assume its resistance does not change), how bright will it be relative to 75-W 120-V bulbs? [Hint: assume roughly that brightness is proportional to power consumed.]
35. (II) An ordinary flashlight uses two D-cell 1.5-V batteries connected in series as in Fig. 18–4b (Fig. 18–36). The bulb draws 450 mA when turned on. (a) Calculate the resistance of the bulb and the power dissipated. (b) By what factor would the power increase if four D-cells in series were used with the same bulb? (Neglect heating effects of the filament.) Why shouldn't you try this?
36. (II) What is the total amount of energy stored in a 12-V, 85-A·h car battery when it is fully charged?

18–7 Alternating Current

43. (I) An ac voltage, whose peak value is 180 V, is across a $330\text{-}\Omega$ resistor. What are the rms and peak currents in the resistor?