6. Can a copper wire and an aluminum wire of the same length have the same resistance? Explain.

7. If the resistance of a small immersion heater (to heat water for tea or soup, Fig. 18–32) was increased, would it speed up or slow down the heating process? Explain.

FIGURE 18–32 Question 7.

8. If a rectangular solid made of carbon has sides of lengths a, $2a$, and $3a$, how would you connect the wires from a battery so as to obtain (a) the least resistance, (b) the greatest resistance?

9. The equation $P = V^2/R$ indicates that the power dissipated in a resistor decreases if the resistance is increased, whereas the equation $P = I^2R$ implies the opposite. Is there a contradiction here? Explain.

10. What happens when a lightbulb burns out?

11. Explain why lightbulbs almost always burn out just as they are turned on and not after they have been on for some time.

12. Which draws more current, a 100-W lightbulb or a 75-W bulb? Which has the higher resistance?

13. Electric power is transferred over large distances at very high voltages. Explain how the high voltage reduces power losses in the transmission lines.

14. A 15-A fuse blows repeatedly. Why is it dangerous to replace this fuse with a 25-A fuse?

15. When electric lights are operated on low-frequency ac (say, 5 Hz), they flicker noticeably. Why?

16. Driven by ac power, the same electrons pass back and forth through your reading lamp over and over again. Explain why the light stays lit instead of going out after the first pass of electrons.

17. The heating element in a toaster is made of Nichrome wire. Immediately after the toaster is turned on, is the current (I_{rms}) in the wire increasing, decreasing, or staying constant? Explain.

18. Is current used up in a resistor? Explain.

19. Different lamps might have batteries connected in either of the two arrangements shown in Fig. 18–33. What would be the advantages of each scheme?

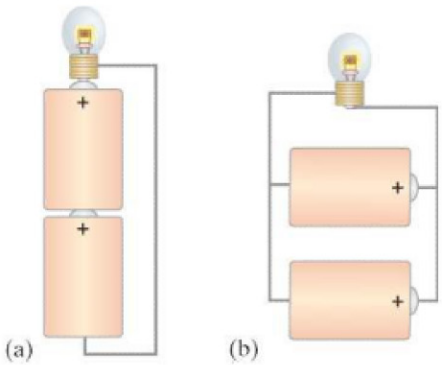

FIGURE 18–33 Question 19.

Problems

18–2 and 18–3 Electric Current, Resistance, Ohms' Law

(*Note:* The charge on one electron is 1.60×10^{-19} C).

1. (I) A current of 1.30 A flows in a wire. How many electrons are flowing past any point in the wire per second?

2. (I) A service station charges a battery using a current of 6.7 A for 5.0 h. How much charge passes through the battery?

3. (I) What is the current in amperes if 1200 Na^+ ions flow across a cell membrane in 3.5 μs? The charge on the sodium is the same as on an electron, but positive.

4. (I) What is the resistance of a toaster if 120 V produces a current of 4.2 A?

5. (I) What voltage will produce 0.25 A of current through a 3800-Ω resistor?

6. (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.)

7. (II) An electric clothes dryer has a heating element with a resistance of 9.6 Ω. (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?

8. (II) A 9.0-V battery is connected to a bulb whose resistance is 1.6 Ω. How many electrons leave the battery per minute?