9. (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?

FIGURE 18–34 Problem 9.

10. (II) An electric device draws 6.50 A at 240 V. (*a*) If the voltage drops by 15%, what will be the current, assuming nothing else changes? (*b*) If the resistance of the device were reduced by 15%, what current would be drawn at 240 V?

11. (II) A 12-V battery causes a current of 0.60 A through a resistor. (*a*) What is its resistance, and (*b*) how many joules of energy does the battery lose in a minute?

18–4 Resistivity

12. (I) What is the diameter of a 1.00-m length of tungsten wire whose resistance is 0.32 Ω?

13. (I) What is the resistance of a 3.5-m length of copper wire 1.5 mm in diameter?

14. (II) Calculate the ratio of the resistance of 10.0 m of aluminum wire 2.0 mm in diameter, to 20.0 m of copper wire 2.5 mm in diameter.

15. (II) Can a 2.5-mm-diameter copper wire have the same resistance as a tungsten wire of the same length? Give numerical details.

16. (II) A certain copper wire has a resistance of 10.0 Ω. At what point along its length must the wire be cut so that the resistance of one piece is 4.0 times the resistance of the other? What is the resistance of each piece?

* 17. (II) How much would you have to raise the temperature of a copper wire (originally at 20°C) to increase its resistance by 15%?

* 18. (II) Estimate at what temperature copper will have the same resistivity as tungsten does at 20°C.

* 19. (II) A 100-W lightbulb has a resistance of about 12 Ω when cold (20°C) and 140 Ω when on (hot). Estimate the temperature of the filament when hot assuming an average temperature coefficient of resistivity $\alpha = 0.0060\,(\text{C}^\circ)^{-1}$.

20. (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.

21. (II) A rectangular solid made of carbon has sides of lengths 1.0 cm, 2.0 cm, and 4.0 cm, lying along the *x*, *y*, and *z* axes, respectively (Fig. 18–35). Determine the resistance for current that passes through the solid in (*a*) the *x* direction, (*b*) the *y* direction, and (*c*) the *z* direction. Assume the resistivity is $\rho = 3.0 \times 10^{-5}\,\Omega\cdot\text{m}$.

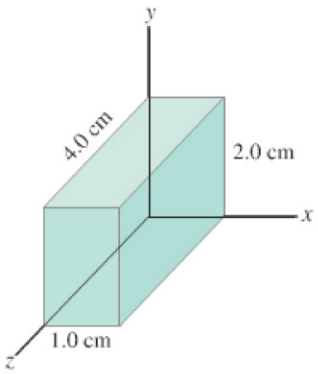

FIGURE 18–35 Problem 21.

22. (II) Two aluminum wires have the same resistance. If one has twice the length of the other, what is the ratio of the diameter of the longer wire to the diameter of the shorter wire?

* 23. (II) A length of aluminum wire is connected to a precision 10.00-V power supply, and a current of 0.4212 A is precisely measured at 20.0°C. The wire is placed in a new environment of unknown temperature where the measured current is 0.3618 A. What is the unknown temperature?

24. (III) A 10.0-m length of wire consists of 5.0 m of copper followed by 5.0 m of aluminum, both of diameter 1.0 mm. A voltage difference of 85 mV is placed across the composite wire. (*a*) What is the total resistance (sum) of the two wires? (*b*) What is the current through the wire? (*c*) What are the voltages across the aluminum part and across the copper part?

* 25. (III) For some applications, it is important that the value of a resistance not change with temperature. For example, suppose you made a 4.70-kΩ resistor from a carbon resistor and a Nichrome wire-wound resistor connected together so the total resistance is the sum of their separate resistances. What value should each of these resistors have (at 0°C) so that the combination is temperature independent?

18–5 and 18–6 Electric Power

26. (I) The heating element of an electric oven is designed to produce 3.3 kW of heat when connected to a 240-V source. What must be the resistance of the element?

27. (I) What is the maximum power consumption of a 3.0-V portable CD player that draws a maximum of 320 mA of current?

28. (I) What is the maximum voltage that can be applied across a 2.7-kΩ resistor rated at $\frac{1}{4}$ watt?

29. (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.

30. (II) A 115-V fish-tank heater is rated at 110 W. Calculate (*a*) the current through the heater when it is operating, and (*b*) its resistance?