Problems

Chapter 5

1. A resistor has a current of 2.00A flow through it for 4.00 minutes.

   (a) Find the total charge (in coulombs) that flows through the resistor.
   (b) Find the total number of electrons that flow through the resistor.

2. An electrical device has a fuse made of a material that melts when the current density reaches 500A/cm^2. The fuse is designed to "blow" (melt) if the current exceeds 2.00A. Find the diameter of the fuse wire.

3. To understand the effect of lightning on a skyscraper one needs to find the resistance of long sections of steel beams. One such beam is 200m long with a cross-sectional area of 50.0cm^2. Find the resistance of this beam along its length if the resistivity of the steel is known to be $3.00 \times 10^{-7}\Omega\text{m}$.

4. A 10.0m long piece of wire has a diameter of 4.00mm. Its resistance is found to be $41.8\text{m}\Omega$. A voltage of 25.0 V is applied across this wire.

   (a) Find the current in the wire.
   (b) Find the current density in the wire.
   (c) Find the resitivity of the material and identify the material using the resistivity table.

5. A piece of copper wire has a resistance R. If it is softened (by heating) and stretched to twice its original length, find its new resistance. Assume the density and resistivity of copper to be unchanged by this process. Also assume the cross-sectional area remains uniform after the stretching even though it decreases.

6. A battery operated device uses a 9.0V battery and is rated to consume 0.50W of power. If the device is left on for 12 hours, find the amount of charge that flows through it.

7. A 100W lightbulb is left on for the whole month of June. It is connected to a standard 120V source. The cost of electricity is \$0.10 per KWh.

   (a) Find the cost of leaving the lightbulb on for the whole month.
   (b) Find the resistance of the lightbulb while in operation.
   (c) Find the current in the lightbulb.