

Homework 6

1. Two wires are connected to a conducting sphere of radius 7.75 cm, which is initially uncharged. One wire carries a current of $3.47 \mu\text{A}$ into the sphere, and another wire carries a current of $1.26 \mu\text{A}$ out of the sphere. How long does it take to produce an electric potential of 5.00 V at a distance of 11.6 cm away from the center of the sphere?
2. A certain lightbulb filament when hot has a resistance of 205Ω . The potential difference across the filament at a certain instant is standard household voltage, 120 V. (a) What current is flowing through the bulb at that time? (b) If the filament of the bulb is a tungsten wire having a radius of $475 \mu\text{m}$, what is the magnitude of the current density in the filament?
3. A piece of iron has a resistance of 103Ω at 40.0°C . Iron has a temperature coefficient of resistivity of $0.00640^\circ \text{C}^{-1}$ at 20.0°C . What is the resistance of the iron at 20.0°C ?
4. Power transmission lines often use a form of electric current called alternating current, but in many regions, such as the Province of Quebec, high-voltage direct-current lines are used instead. Direct current is the kind of electric current you are studying in this chapter. A certain direct-current power transmission line has a resistance of $0.255 \Omega/\text{km}$. 812 kV of potential drives the current from the generating station to a city located 125 km from the plant. What is the power loss due to resistance in the line?