27-Series Problem (Current and Resistance)

27.7) The charge flow in a wire varies with time as $q = 4t^3 + 5t + 6$. The surface area of the wire is $2.00\ cm^2$.

a.) Derive an expression for the instantaneous current through the wire, then evaluate it for *t = 1.00 seconds*.

b.) Derive an expression for the current density through the wire.

27.12) A lightbulb plugged into a 120 volts source has a resistance of $240\ \Omega$. Determine the current flowing through the bulb.

27.14) A tungsten wire with a 0.600 square-millimeter cross-sectional area and 1.50 meter length is attached to a 0.900 volt source. Determine the current that passes through the wire.

27.23) The resistance of a lightbulb filament is different when the bulb is "cold," versus when it has heated up to running temperature. What is the fractional change in resistance when the bulb temperature goes from 25.0^o to 50.0^o. Note that the temperature dependent relationship for resistance is $R = R_o\left[1 + \alpha\left(T - T_o\right)\right]$, where R_o is the resistance at temperature T_o and α is the *temperature coefficient of resistivity* for the material, which in this case is tungsten.

27.29) When connected to a 120 volt outlet, a waffle iron pulls 1.00 kW of power.

a.) How much current does the iron draw?

b.) What is the resistance associated with the iron when current is being drawn?

27.33) If you connect a 100 watt lightbulb to a 120 volt source, it will experience a 140 volt surge for just a moment. Assuming the bulb's resistance doesn't change, by what percent does the power output increase during this surge?

27.35) Batteries obviously die with time, so the amount of time they can sustain their peak voltage is an important bit of information to know. As such, batteries are sometimes rated in *amp-hours*. (Example: a battery that can sustain 4 volts for 6 hours would be rated at 24 amp-hours.)

a.) Let's assume you have a battery rated at 55 amp-hours that runs at 12.0 volts. How much energy, in kilowatt-hours, can that battery provide to a circuit?

b.) How much is that energy worth if the cost of one kilowatt-hour was eleven cents (i.e., $0.11)?

27.39) At $0.11 per kilowatt-hour, what is the daily cost of running a lamp that draws 1.70 amps from a 110 volt source?