Flipping Physics Lecture Notes:
Electric Power
http://www.flippingphysics.com/electric-power.html

Now we get to discuss *electric power*, which is the rate at which electric potential energy is converted to other types of energy such as heat, light, and sound.

$$P = \frac{dU}{dt} \Rightarrow P_{elec} = \frac{dU_{elec}}{dt} = \frac{d(q\Delta V)}{dt} = \frac{dq}{dt}\Delta V \Rightarrow P = I\Delta V$$

$$\& \ \Delta V = IR \Rightarrow P = I(IR) = I^2R$$

$$\& \ I = \frac{\Delta V}{R} \Rightarrow P = \left(\frac{\Delta V}{R}\right)^2 R = \frac{\Delta V^2}{R}$$

$$\Rightarrow P = I\Delta V = I^2R = \frac{\Delta V^2}{R}$$

A unit which is often used when it comes to electricity is the kilowatt-hour:

$$1kW\cdot hr\left(\frac{1W}{1000kW}\right) = 1000W\cdot hr = 1000\left(\frac{J}{s}\right)hr\left(\frac{3600s}{1hr}\right) = 3.6\times10^6 J$$

In other words, the kilowatt-hour is a misnomer (or maybe just misleading). It sounds like a unit of power; however, it is a unit of energy. And we know: $1kW\cdot hr = 3.6MJ$

A light bulb is a common item used in physics. It is a resistor which converts electric potential energy to light, heat, and sound energy. The brightness of a light bulb increases with increasing power; therefore, the brightness of a light bulb is often used to demonstrate the power in an electric circuit. Speaking of electric circuits…