

Physics 2  
Elementary Physics of Energy

**Homework 5**

Due Date: May 12, 2011

1. A pack of batteries produces a voltage of 60V in a circuit containing two resistances  $R_1$  and  $R_2$  in series with magnitude 5 and 1 ohms. Find the voltage drop across each resistance and the Joule heat produced in each resistor. [15]
2. In the above problem, let us put the two resistors in parallel. Calculate now the voltage drop and Joule heating produced in each resistor.[15]
3. The power station problem considered in class produces power of 1000 MW that is transmitted across a line with resistance 2.2 Ohms at an initial voltage of 800,000 Volts. Find the voltage at the user end. What is the user end voltage when the initial voltage is halved?[15]
4. A bulb has a power rating of 60 Watts and is connected to the outlet voltage of 115 volts. Calculate the resistance in Ohms, and find the charge passing through it in 5 minutes in Coulombs. (For this calculation, the current may be taken as DC)[15]
5. A hot-tub heater with resistance of 11.5 Ohms is used in a household with voltage 115 volts, for 2 hour every morning. Assuming that it is used to heat up water at 80% efficiency, and that the temperature boost required is 50<sup>0</sup>C, what is the quantity of water used each day? What are the electricity charges for this usage per month? (Assume 12 cents/ kWh charges).[40]

{ This problem requires you to bring together two concepts learned in the lectures at different times, and will help you to develop a global view. Break it up into two parts, one using Ohm's law and the other using heat capacity and then connect them }