PHYSICS-2
Elementary Physics of Energy

Homework 5
Due Date: May 11, 2012

This set of problems has no correspondence to those in RK, but are based on class notes and the hand out on resistances that is in the "Resources" folder. If necessary, you can look up the other books on reserve.

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. You may assume the formula for total current in this circuit to be $I = V/(R_1 + R_2)$ as appropriate for this case. [20]

2. 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]

3.   (a) A bulb has a power rating of 100 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]

   (b) What is the power consumed if you use this bulb at a different voltage 240 V? [5]

   (c) Explain why it would not make sense to do what is suggested in (b)? [5]

4. 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 50^0C, 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}