**Assignment V, HONS 158 (Honors Physics II)**
**Spring 2016**
**Due 2/17/16 at start of class**

As always, please put your answers on separate paper.

1. Do problem 26 in Chapter 27 of your text. Except – using $x$ is awkward. Rather, let's use $\alpha$ as "the fraction that $x$ covers of $R_\circ$" so that when $\alpha = 0$, $x = 0$ and when $\alpha = 1$, $x = 0.1$ m. Leave your answer for the power dissipated in terms of $V$ (the voltage of the battery, marked as a funky $\mathcal{E}$ in your text), $\alpha$, $R$, and $R_\circ$ *only*.
2. Do problem 37 in Chapter 27 of your text.
3. Examine figure 27-53 in your text. Let the battery have voltage 10 V, and Let $R_1$, $R_2$, $R_3$, and $R_4$ have resistances of 1 kΩ, 2 kΩ, 3 kΩ, and 5 kΩ (respectively). Find:
   a) The total resistance of the circuit.
   b) The current through each resistor in the circuit.
   c) The power dissipated via each resistor in the circuit.
4. Examine figure 27-54 in your text. Let the emfs of the three batteries (in numerical order) be 5 V, 9 V, and 12 V. Let $R_1$ be 1 kΩ and $R_2$ be 3 kΩ. Find:
   a) The current through $R_2$.
   b) The current through Battery 1.
   c) The current through Battery 3.
5. To operate a camera flash, a charge of 38 $\mu$C is required.
   a) If you need to store this charge in a capacitor that has a potential between its place of 9 V, what capacitance must the capacitor have?
   b) When this capacitor is fully charged, how much energy does it store?
   c) Let us assume this is a parallel-plate capacitor with separation between the plates of 0.1 mm. The plates are circular in shape. What must the radius of each plate be, if the gap is filled with air?
   d) What is the electromagnetic energy density between the plates? (There is two ways to do this; both should work).
   e) Same as part (c) above, but now let the gap be filled with water ($\kappa \sim 80$).
6. If you have a ten 1 kΩ resistors, you can design a sub-circuit ranging anywhere from 100 Ω (putting all resistors in parallel with each other) to 10000 Ω (putting all resistors in series).
   a) Consider a voltage difference $V$ that drives a sub-circuit. Which of the two resistor alignments alluded to above results in the greatest total power dissipated through the resistors? (Justify your answer with calculations and/or detailed reasoning).
   b) Come up with a resistor alignment involving 7 1 kΩ resisters (or fewer) that gives a total resistance of 1750 Ω.