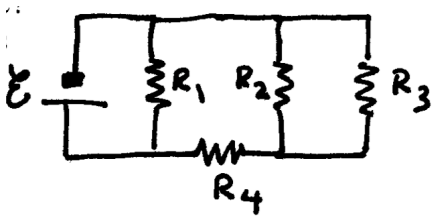
Physics 4L, Spring 2010 — Problem set 7
Due Tuesday March 23 in class

Wolfson chapter 25, problems 33, 58, 63, 74, 75, and the following additional problems:

Additional problems:

1. In the circuit shown, $\mathscr{E} = 9.0$ V, $R_1 = 600\ \Omega$, $R_2 = 300\ \Omega$, $R_3 = 600\ \Omega$, and $R_4 = 400\ \Omega$. Find the current in R_4 and indicate its direction clearly on a diagram of the circuit in your solution.



2. Consider a battery charging an RC circuit as in Fig. 25.19.
Show that only half of the total energy drawn from the battery is stored in the capacitor. (You do not need to integrate to show this.)

For extra credit: (b) Show that the remaining energy is dissipated in the resistor by integrating the power dissipated in the resistor over time. (You can look up the integral you need in Appendix A.)

Also note there is an extensive warmup assignment for next week's lab on discharging capacitors that will give you additional practice with these ideas.

Magnetism problems will be on PS 8. If we get far enough in class Thursday 3/18 that you want to do some magnetism problems, here are a few to get started on:

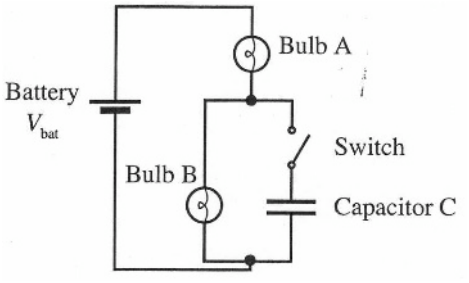
Wolfson chapter 26, "For Thought and Discussion" question 3, problem 18, and the following problem:

3. Wolfson Chapter 26 problem 26, and also determine the potential difference that would be used to accelerate the electrons before they travel into the magnetic field in order to give the maximum electron energy of (b).

Self-test problem, PS 7 Name _____

You may spend up to 30 minutes on this problem and consult the equation sheet posted online. Your score on this problem will not be included in your homework grade; it is solely for feedback to you. (However, you *will* receive credit for one homework problem for completing it.)

Consider the circuit shown to the right. The bulbs in the circuit are identical and each has a resistance of R = 100 Ω; the battery supplies 10 V. Initially the capacitor is uncharged and the switch is opened.



(a) Just after the switch is closed, find the potential difference across each of the bulbs and across the capacitor, and give the currents in each of the bulbs, in the branch with the capacitor, and in the battery. Explain your reasoning briefly.

(b) A long time after the switch is closed, find the potential difference across each of the bulbs and across the capacitor, and give the currents in each of the bulbs, in the branch with the capacitor, and in the battery. Explain briefly.

(c) Describe the how the brightness of bulbs A and B changes with time from just after the switch is closed until a long time later. (Continue on the back if you need more space)