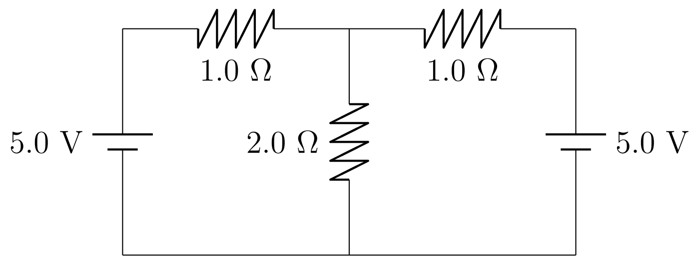
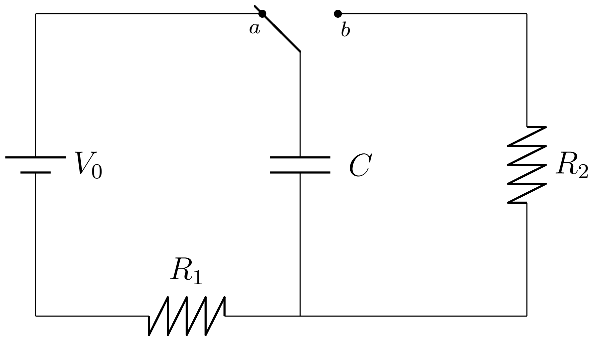
Assignment 4; Phys 186 Name ________________

1. (20 points) You have the following circuit. Calculate the voltage across, the current through, and the power dissipated by each resistor.



2. (30 points) Here is a simplified (oversimplified) model of a circuit for a camera flash. The resistance R_1 is considerably larger than R_2. When the switch is at a, the capacitor C slowly recharges. When the switch is at b, C rapidly discharges.



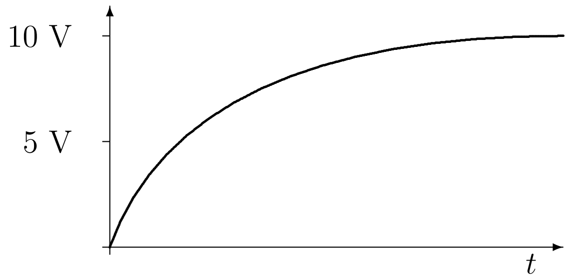
(a) Say the switch remains at a for a long time in order to fully charge up the capacitor. This is a "long time" compared to what?

(b) What is the power dissipated by R_2 immediately after the switch is flipped to b? Explain, using this, why a flash requires a small value for R_2.

(c) Say $C = 12\ \mu\text{F}$, and $R_2 = 0.21\ \Omega$. How long will it take for the capacitor to discharge 90% of its starting charge?

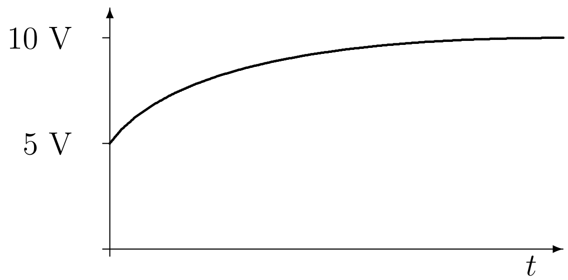
3. (50 points) You have a capacitor (its capacitance is not important), a switch, wires, a 15.0 V DC battery, a 5.0 Ω resistor, and a device that behaves like a 10.0 Ω resistor.

(a) You want the voltage across your device to behave like the following graph after you close the switch; starting at 0.0 V and gradually going up to 10.0 V:



Draw a circuit diagram for the circuit that will do this. Write the junction and loop equations and show that that immediately after you close the switch and a long time after you close the switch, the voltage across your device will be 0.0 V and 10.0 V.

(b) Let's say that instead of the situation in (a), your device requires a voltage graph looking like the following, starting at 5.0 V and gradually going up to 10.0 V:



You can accomplish this by adding an extra resistor R to the circuit that you had for (a). Draw the circuit with the extra resistor R, and use loop and junction equations to calculate the value of R for which the voltage across the device will be 5.0 V immediately after closing the switch and 10.0 V a long time after.