

*Massachusetts Institute of Technology*

*Spring Term 2005*

**8.02X Electricity and Magnetism**

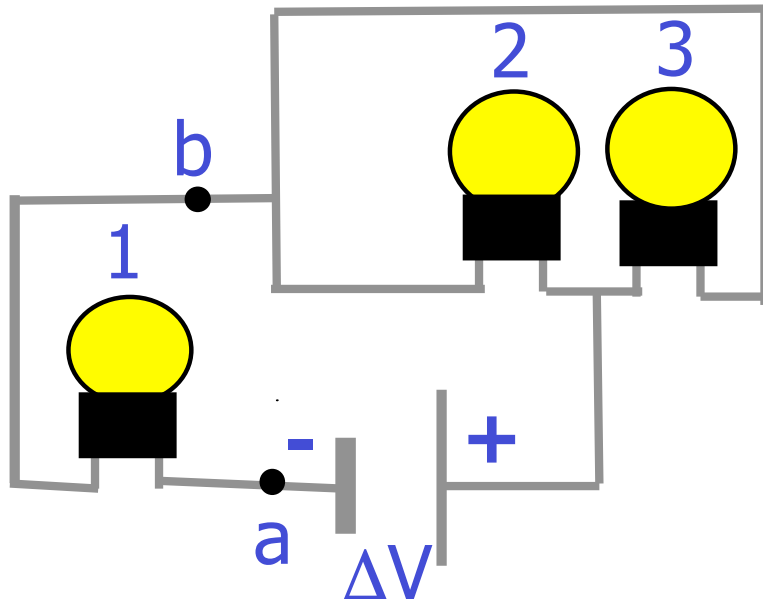
**Practice Quiz #2a**

**Problem 1 (25 points)**

**Shown below is a circuit consisting of a power supply with an output voltage  $\Delta V$  and three identical light bulbs. *For all answers, explain your reasoning in one or two sentences.***

**(a) Which of the bulbs will burn most brightly or will they all show the same brightness?**

**(b) Suppose bulb 2 was replaced with a bulb with twice the power rating. Would bulbs 1 and 3 burn brighter, less bright or be unaffected? Explain your reasoning.**

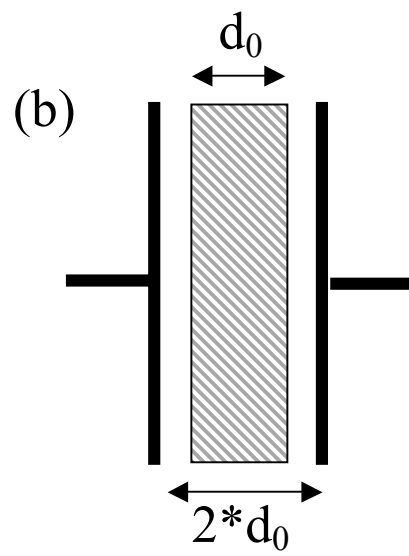
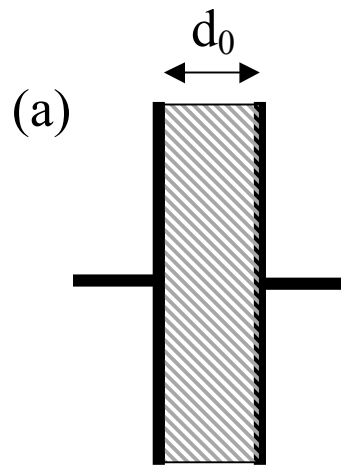


**Problem 2 (25 points)**

**A glass plate with dielectric constant  $K=2$  is inserted into a parallel plate capacitor with area  $A$  and distance  $d_0$  between plates. Using a power supply, the capacitor is charged to a charge  $Q$ . The power supply is NOT disconnected.**

**(a) What is the energy stored in the capacitor?**

**(b) The separation between the plates is increased to  $d=2d_0$ , but the glass plate remains in the same position. What is  $U_{\text{stored}}$  now?**



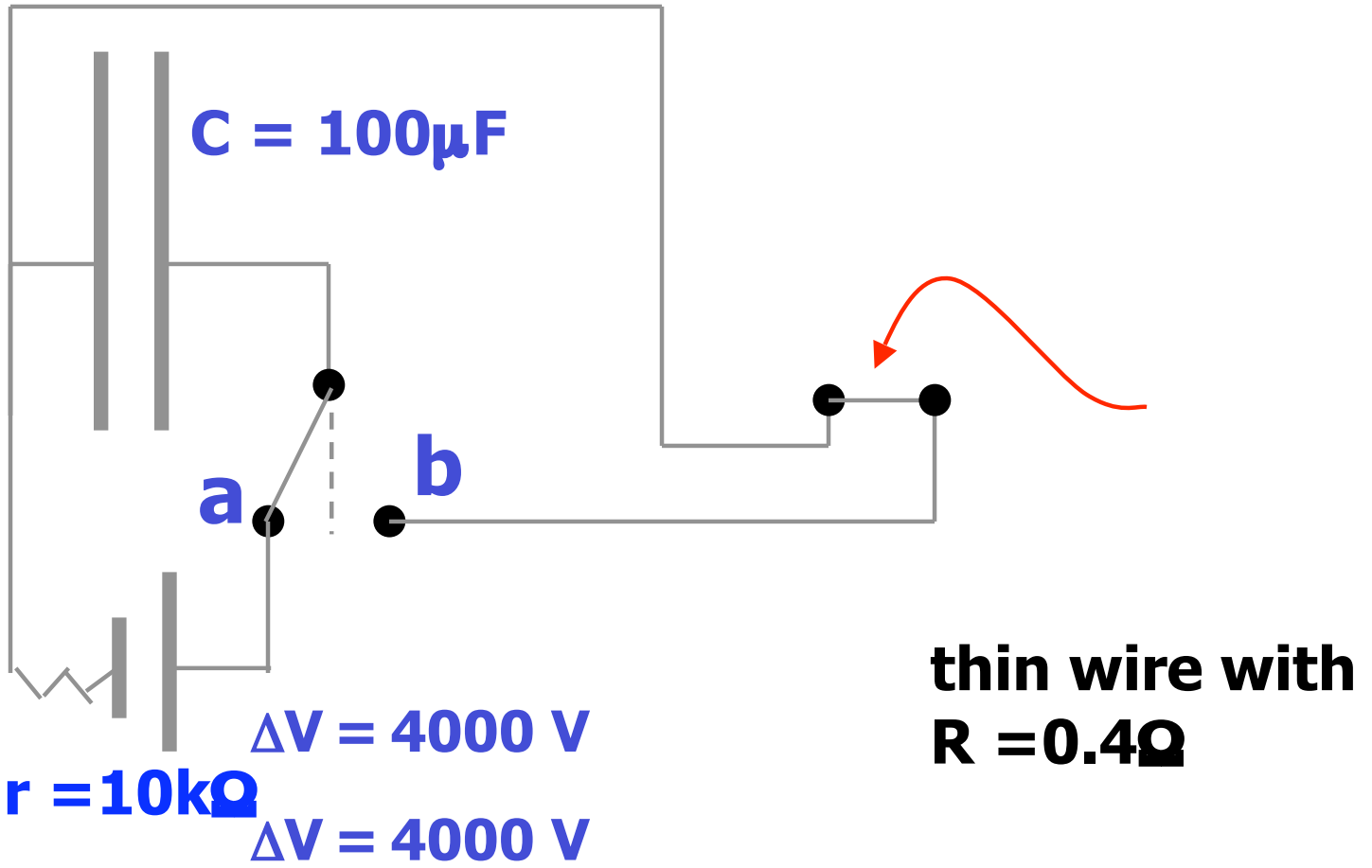
**Problem 3 (25 points)**

In one of the lecture demos, a large capacitor was charged using a power supply with an output voltage of 4000V and internal resistance of 10k $\Omega$ . Assume that at times  $t < 0$  the capacitor is completely uncharged. Then the switch is moved to position a to charge the capacitor.

(a) Sketch how the charge  $Q$  on the capacitor will change as a function of time for  $t < 0$ .

(b) At which time  $t$  will the power delivered by the power supply be maximal? Explain in one or two sentences.

(c) What is the maximum power provided by the power supply?



**Problem 4 (25 points)**

**Shown below is a schematic view of experiment EF. Assume the foil jumps at a potential difference between the plates of 300V. For questions (a) and (b), give the (approximate) reading of MM1 and MM2 in Volts (assume MM1 and MM2 have identical characteristics).**

- (a) What are the readings of MM1 and MM2, immediately after the foil jumps and connects the two washers?**
  
- (b) What are the readings of MM1 and MM2, immediately before the foil jumps and connects the two washers?**
  
- (c) Determine the electric force on the foil for a potential difference  $\Delta V < 400 \text{ V}$  (i.e. before the foil jumps). The foil carries charge  $Q$ , the distance between washers is  $d$ .**



