

Massachusetts Institute of Technology

Spring Term 2005

8.02X Electricity and Magnetism

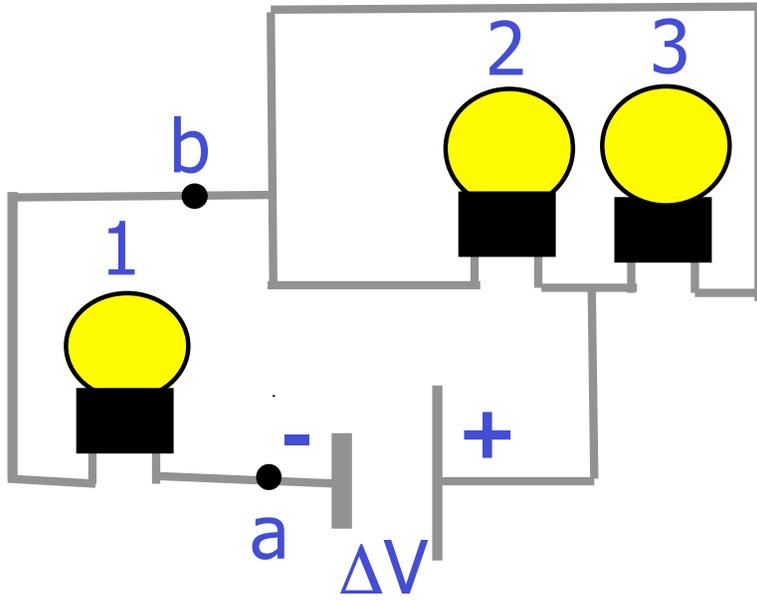
Practice Quiz #2a

Problem 1 (25 points)

Shown below is a circuit consisting of a power supply with an output voltage ΔV 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.

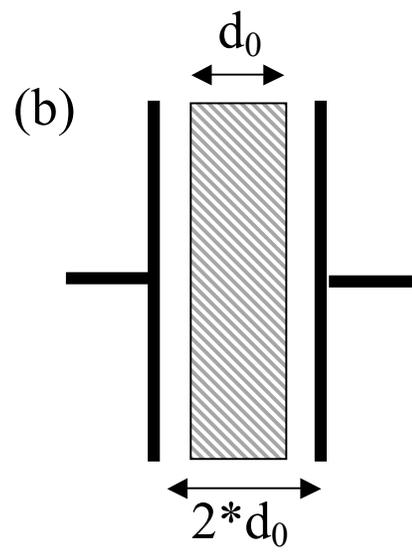
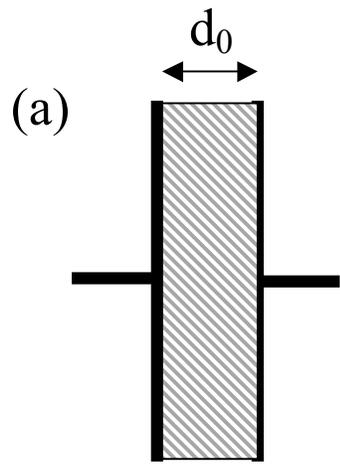


Problem 2 (25 points)

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_{stored} now?



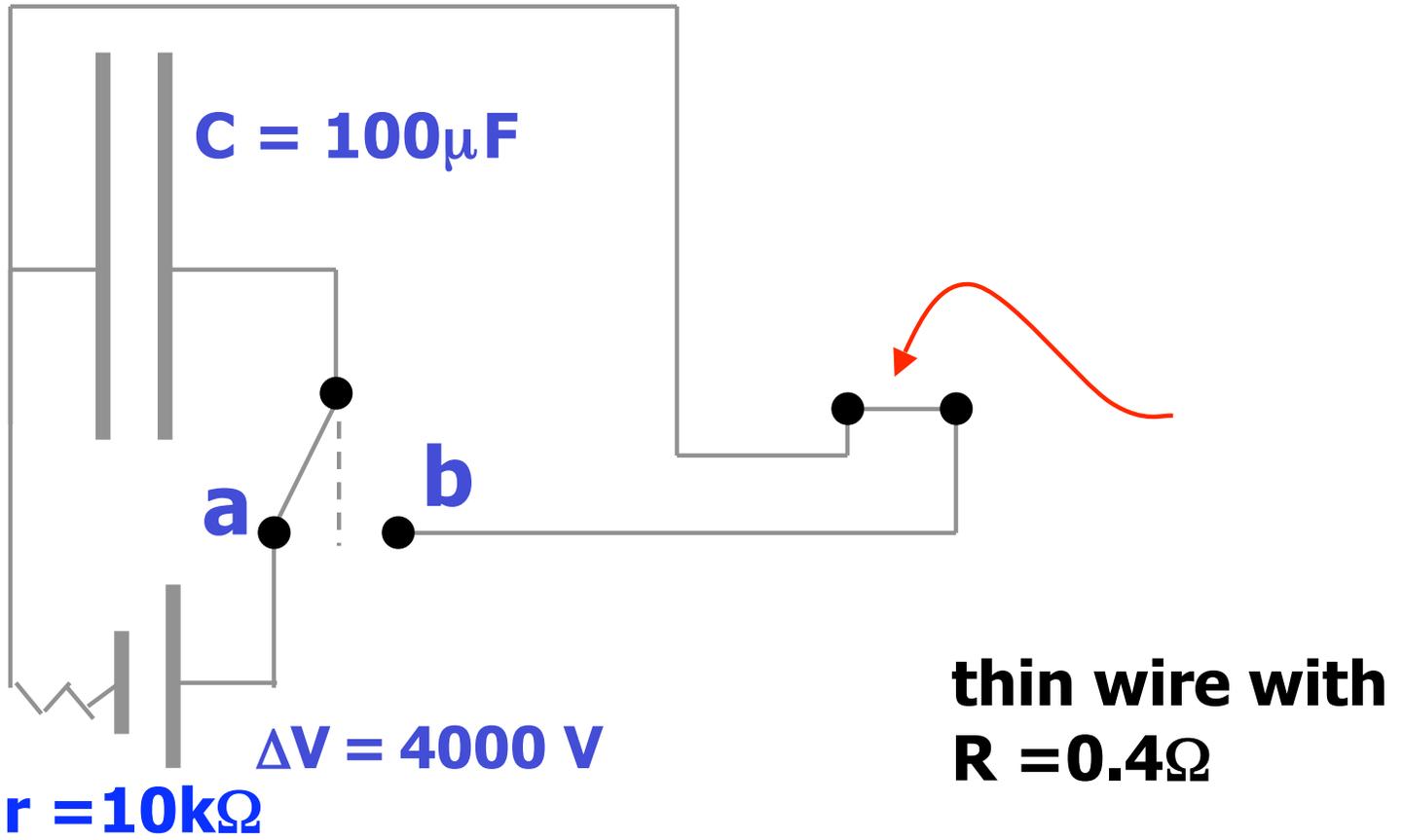
Problem 3 (25 points)

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 Ω . 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 .**

