

## 8.02x Electricity and Magnetism

### Problem Set 5

**Issued:** Fri, Mar 4

**Due:** Fri, Mar 11, 4PM <- note Date + Time!

**Note that the EF write-up from both lab partners is also due on 3/11 4PM!**

#### Reading suggestions (from Young & Freedman)

Mon: Electric Current, Resistivity, Circuits, chapters 25-1 to 25-5

Wed: DC Circuits, Kirchoffs Rules, chapters 26-1 to 26-3

Fri: Quiz 2 review

### Homework Problems (30 points total)

**Problem 1 (10 points)** Consider a simple parallel plate capacitor of Area  $A$  for each plate and separation  $d$  between the plates. The plates are given equal and opposite charges  $Q$  and the capacitor is isolated from the rest of the world

- What is the potential difference between the plates in terms of the given variables?
- What is the stored energy in the capacitor?
- Assume the plates are moved from a separation  $d$  to  $2*d$ . How much does the stored energy in the capacitor change?
- Show that the change in potential energy in question (c) is identical to the work done on the plates when moving them from  $d$  to  $2*d$ .
- Assume a dielectric with dielectric constant  $k=10$  is inserted such that it fills the gap of the capacitor. How much does the stored energy change? How is energy conservation satisfied?

**Problem 2 (5 points)** For the HVPS experiment, you found that the voltage across the output capacitor was lowest when the load had the lowest resistance. Explain this observation.

**Problem 4 (5 points)** Young&Freedman, page 972, Question Q25.11

**Problem 5 (5 points)** Young&Freedman, page 975, 25.34

**Problem 6 (5 points)** Young&Freedman, page 975, 25.38

**Note that check-off and experiment write-up for experiment 'Electrostatic Force (EF)' are due on Fri, 3/11. EF questions were provided in a separate document. There will be 2 bonus points for EF check-off on 3/7 and 1 bonus point on 3/8.**