Massachusetts Institute of Technology *Spring Term 2005*

8.02X Electricity and Magnetism

Problem Set 6

Issued: **Thu, Mar 10**
Due: **Fri, Mar 18, 4PM <- note Date + Time!**

Note that the VI write-up from both lab partners is due on 3/18 4PM!

Reading suggestions (from Young & Freedman)
Mon, 3/14: Quiz #2
Wed, 3/16: RC Circuits, chapter 26-4
Fri, 3/18: Magnetism, chapter 27-1

This problem set only consists of the write-up for the VI experiment

Experiment VI (20 points)

You will be graded according to the following criteria:

1. You have completed all the measurements in the experiment. Your understanding of the underlining physical principles involved in the experiment. You may be asked a question during the check-off.

2. The results of your data analysis.

Problem 1: ***Experiment VI: Voltage and Current***

Arrange experimental apparatus as directed in the Experiment VI: Voltage and Current write-up and record measurements on the appropriate tables below.

1 ---Resistors and Lamps (all values in ohms)
Resistance of three 43 Ω resistors:
R_1 = _____, R_2 = _____, and R_3 = _____.
R_{AB} = _____, R_{BC} = _____, and R_{AC} = _____.

Resistance of Lamps:
#47 = _____, #1157, 8W = _____, #1157, 27W = _____.

2.Voltage Measurements:
2a---Voltage Divider
Voltages (in volts): V_{AB} = _____, V_{BC} = _____, V_{AC} = _____.
Current (in amperes) through Resistors: I_1 = _____, I_2 = _____, I_3 = _____.
Power (in watts) dissipated by Resistors: P_1 = _____, P_2 = _____, P_3 = _____.

2b---Voltage and Current
Current (in amperes) through Resistor R_1: I_1 = _____.
Power (in watts) dissipated by Resistor R_1: P_1 = _____,

2c---Voltage and Current
Current (in amperes) through Resistors R_2 and R_3: I_2 = _____, I_3 = _____.
Power (in watts) dissipated by Resistors R_2 and R_3: P_2 = _____, P_3 = _____.

3---Voltage-Current (V-I) Characteristics

3a) 43 Ω	3a) 43 Ω	3b) #47	3b) #47	3c) #1157 8W	3c) #1157 8W	3c) #1157 8W
Voltage (V) across 43 ❑	Current (A)	Voltage (V) across #47	Current (A)	Voltage (V) across #1157	Res. Wire (mV)	Current (A)

Length of resistance wire (in mm) = _____.
Resistance of wire (inΩ) = _____.

4--- Some LVPS Properties

No Load Voltage $V_{no\ load}$ (V)	Voltage with Load V_{load} (V)	$V_{no\ load} - V_{load}$ (V)

4b--- LVPS Short Circuit Current (in amperes) I_{SC} =_____.

5--- Charging a Capacitor

MMM reading	Time (s)
5.0	
4.5	
4.0	
3.5	
3.0	
2.5	
2.0	
1.5	
1.0	
0.5	

Problem 2: ***Electrostatic Force Measurements:***

In the Electrostatic Force Experiment, you measured the voltage difference across the washers when the aluminum foil just started to jump up. When the foil jumps up, it connects the two plates, short-circuiting the capacitor. Suppose that just when the current starts to flow, the voltage difference across the HVPS drops from 340V to 300V. The HVPS has an internal resistance $r_{int} = 3.1 \times 10^6 \Omega$. When the foil jumps, current now flows through the second multimeter as well as the first. The second multimeter registers a value of 300V as well. The multimeters when set on the +DC 1000 V scale have a resistance, $R = 20.0 \times 10^6 \Omega$.

a) Just before the aluminum foil jumps, calculate the current that flows through the multimeter connected to the output of the HVPS.

b) What is the electromotive force supplied by the HVPS?