PHYS 122 A, B Spring 2012
MIDTERM 2
May 3rd 2012

NAME:_____
Last First
Student #_____

PART I Multiple Choice – Each question is worth 5 points – total 55 points

Positive charge is placed on two conducting spheres that are very far apart and connected by a long, very thin conducting wire. The radius of the larger sphere is 12.0 cm and the radius of the smaller sphere is 5.0 cm. The electric field strength at the surface of the larger sphere is 400kV/m.

1. What is the surface charge density of the larger sphere?

A. 2.23 $\mu C/m^2$
B. 3.54 $\mu C/m^2$
C. 4.32 $\mu C/m^2$
D. 6.47 $\mu C/m^2$
E. 8.49 $\mu C/m^2$

2. What is the potential at the surface of the smaller sphere? (Assume the potential is zero at infinity.)

A. 20 kV
B. 32 kV
C. 48 kV
D. 96 kV
E. 115 kV

3. What is the surface charge density of the smaller sphere?

A. 2.23 $\mu C/m^2$
B. 3.54 $\mu C/m^2$
C. 4.32 $\mu C/m^2$
D. 6.47 $\mu C/m^2$
E. 8.49 $\mu C/m^2$

PHYS 122 A, B Spring 2012 NAME:_____

MIDTERM 2 Last First
May 3rd 2012 Student #_____

Two plates of a parallel plate capacitor are separated by distance d, and each has area A. The capacitor is charged to a potential difference V_0 and then disconnected from the voltage source. The plates are then pulled apart until the separation becomes $3d$.

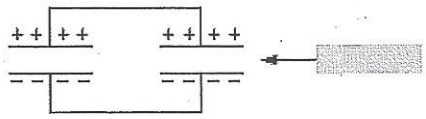
4. What is the new potential difference between the plates of the capacitor? (Express your answer in terms of the original potential difference, V_0.)

A. V_0
B. $3V_0$
C. $9V_0$
D. $0.33V_0$
E. $0.11V_0$

5. How much work was required in order to change the plate separation from d to $3d$?

A. $\varepsilon_0 A V_0 / d$
B. $\varepsilon_0 A V_0 / 2d$
C. $\varepsilon_0 A V_0^2 / d$
D. $\varepsilon_0 A^2 V_0 / d$
E. $\varepsilon_0 A^2 V_0^2 / 2d$

6. Two capacitors each have two conducting plates of surface area A and an air gap width d. They are connected in parallel, as shown in the figure, and each has a charge Q on the positively charged plate. A slab that has a width d, area A, and a dielectric constant κ is then inserted between the plates of *one* of the capacitors. Find the new charge Q' on the positively charged plate of the capacitor with the dielectric. Assume that electrostatic equilibrium has been reestablished.



A. $\kappa Q / (1+\kappa)$
B. $2\kappa Q / (1+\kappa)$
C. $\kappa Q / (1+\kappa)^2$
D. $\kappa Q / (1+2\kappa)$
E. $2\kappa Q / (1+2\kappa)$

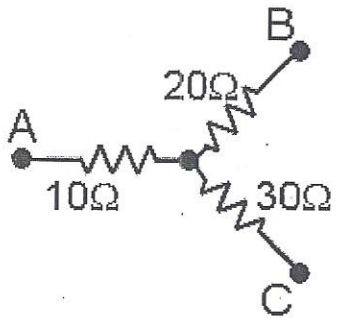
PHYS 122 A, B Spring 2012
MIDTERM 2
May 3rd 2012

NAME:_____
Last First
Student #_____

7. A current of 1 A flows through a round copper wire with diameter 0.5 mm when it is connected across a potential difference of 30 V. How long is the wire? The resistivity of copper is 1.68×10^{-8} ohm-meter.

A. 234 meters
B. 589
C. 54
D. 350
E. 139

8. The voltages at point A, B, and C, are 10V, 6V, and 5V, respectively. What is the current through the 10Ω resistor?



(a) 0.2 Amps
(b) 0.4
(c) 0.6
(d) 0.8
(e) 1.2

9. A flash unit for a camera consists of an RC circuit with R = 20 kilo-ohms. What capacitance C is needed if the unit is to charge to 50% of full charge in 10 seconds?

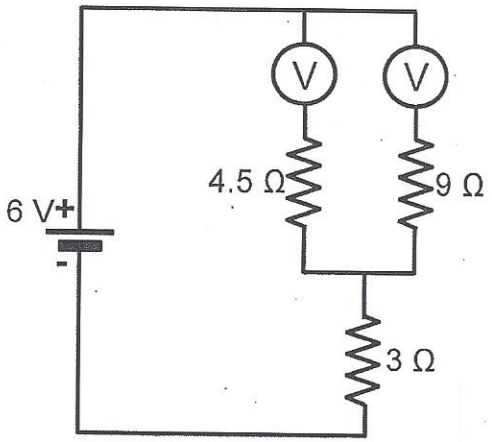
A. 721 microfarads
B. 1112
C. 447
D. 1443
E. 914

PHYS 122 A, B Spring 2012
MIDTERM 2
May 3rd 2012

NAME:_____
Last First
Student #_____

10.
Consider the circuit at right. Both meters are voltmeters. Which reading combination is most correct?

A) $V_{left} = 0.0$ V, $V_{right} = 0.0$ V
B) $V_{left} = 1.0$ V, $V_{right} = 2.0$ V
C) $V_{left} = 2.0$ V, $V_{right} = 1.0$ V
D) $V_{left} = 3.0$ V, $V_{right} = 3.0$ V
E) $V_{left} = 6.0$ V, $V_{right} = 6.0$ V



11.
Consider the circuit at right. In this circuit both meters are ammeters. Which reading combination is most correct?

A) $i_{left} = 0.0$ A, $i_{right} = 0.0$ A
B) $i_{left} = 1.0$ A, $i_{right} = 1.0$ A
C) $i_{left} = 0.33$A, $i_{right} = 0.67$ A
D) $i_{left} = 0.67$ A, $i_{right} = 0.33$ A
E) $i_{left} = 4.0$ A, $i_{right} = 2.0$ A