

Physics 122
Midterm Examination #1
February 22, 2007

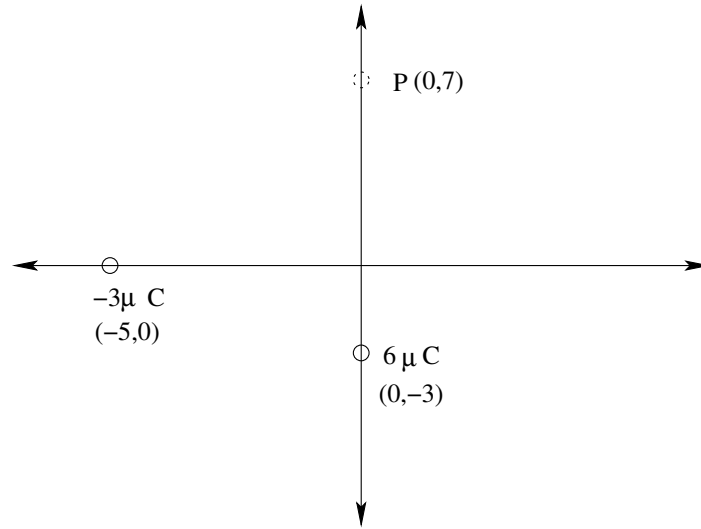
Name: _____

Recitation Section: _____

Lab Section: _____

	Score
Problem 1	
Problem 2	
Problem 3	
Problem 4	
Problem 5	
Total	

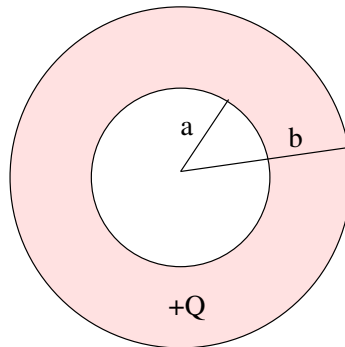
1. Shown in the figure below are two point charges. The locations of the charges are specified on the graph in units of meters. Answer all the



following:

- Determine the magnitude and direction of the total electric field at the point P.
- Determine the potential at the point P.

2. Shown in the figure below is an insulating hollow sphere with inner radius a and outer radius b . The region $a < r < b$ is uniformly filled with a total charge $+Q$. Use Gauss Law to find the electric field in each of these

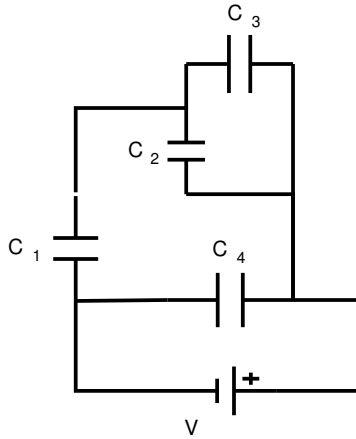


regions:

- (a) Region I ($r < a$).
- (b) Region II ($a < r < b$).
- (c) Region III ($r > b$).

NOTE: You must show *explicit work* in part (b). However parts (a) and (c) can receive full credit for the correct solution calculated in your head and simply presented on the paper.

3. Shown in the figure below is a capacitor network. The voltage on the battery is $V=10$ V.



- (a) Use the rules for capacitors in series and parallel to fill in the values to the following table:

Element	C (μ Farads)	V (Volts)	Q (μ Coulombs)
C_1	$6 \mu F$		
C_2	$2 \mu F$		
C_3	$4 \mu F$		
C_4	$7 \mu F$		

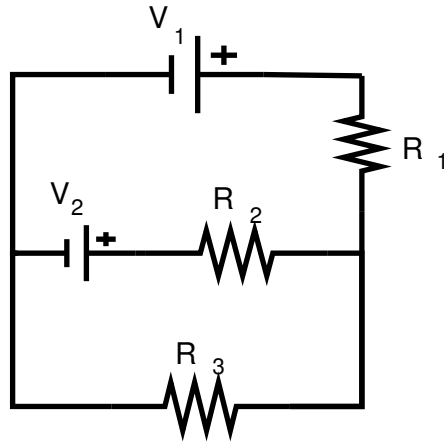
The Rules: You do not need to show explicit calculations used to get the results for this problem (many of the calculations can be done in your head). This means that the scoring for this problem is based simply upon whether the numerical results are right or wrong (full credit for each correct number, zero credit for each incorrect number). **BE CAREFUL** in all your calculations.

4. A hot-water heater is rated at 4620 W and operates at 240 V.
- Find the resistance of the heating element, and the current.
 - How long does it take to heat 125 kg of water from 12°C to 50°C, neglecting conduction and other losses?

NOTE: You may or may not find the following constants useful:

Constant	Value
c_{ice}	$2050 \frac{J}{kg \cdot K}$
c_{water}	$4186 \frac{J}{kg \cdot K}$
c_{steam}	$2080 \frac{J}{kg \cdot K}$
L_{fusion}	$334000 \frac{J}{kg}$
$L_{vaporization}$	$2258000 \frac{J}{kg}$
T_{melt}	0°C
T_{boil}	10°C

5. Shown in the figure below is a circuit diagram. The resistors have values: $R_1 = 5 \Omega$, $R_2 = 4 \Omega$, $R_3 = 3 \Omega$ and carry currents I_1 , I_2 , and I_3 respectively. The batteries have values: $V_1 = 5 V$, $V_2 = 10 V$.



- (a) Place *neatly drawn* arrows on the circuit diagram above that *clearly* indicate your choices for the directions of the three currents in the circuit.
- (b) Determine the currents I_1 (through R_1), I_2 (through R_2), and I_3 (through R_3).