Physics 112
Exam #2
October 22, 1999
Name: _____

YOU MUST RECORD ALL ANSWERS ON THE ANSWER SHEETS!! NOTHING WRITTEN ON THE QUESTION SHEETS WILL BE GRADED!!

#1-7 are NO PARTIAL CREDIT; 4 points each. If you want one of them graded out of 4.5 points (–1 [minus one] for wrong answer!!!) mark the indicated box on the Answer Sheet with an "X."
#8-12 require diagrams, rankings, or explanations. Record everything on the answer sheet. Points indicated for each question.
Total: 50 points

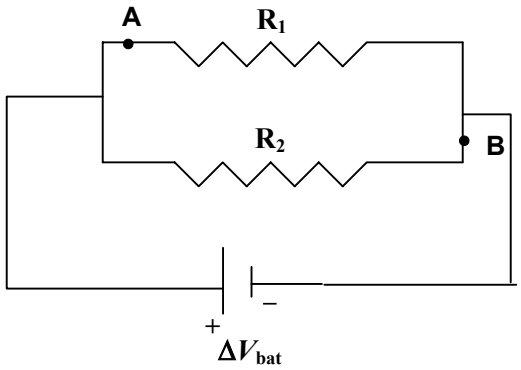
1. A small charged object (a "source" charge) is located in the center of a room. When a test charge is located 63 meters from the charged object, it experiences a force of magnitude 4 N. If that same test charge is moved to a distance 20 centimeters from the charged object, which of these values will be ***closest*** to the magnitude of the force on it now?

   A. 0.004 N
   B. 0.04 N
   C. 0.4 N
   D. 4 N
   E. 40 N
   F. 400 N
   G. 4000 N
   H. 40,000 N
   I. 400,000 N

2. A 5-ohm and a 2-ohm resistor are connected in series to a battery. In a separate circuit, a 5-ohm and a 2-ohm resistor are connected in parallel to a battery with the ***same*** voltage. In which resistor is the ***most power*** being dissipated?

   A. The 5-ohm resistor in the series circuit.
   B. The 5-ohm resistor in the parallel circuit.
   C. The 2-ohm resistor in the series circuit.
   D. The 2-ohm resistor in the parallel circuit.
   E. Both resistors in the series circuit, which dissipate the same amount of power.
   F. Both resistors in the parallel circuit, which dissipate the same amount of power.
   G. All four resistors dissipate the same amount of power.

Questions #3 and #4 refer to the following circuit:



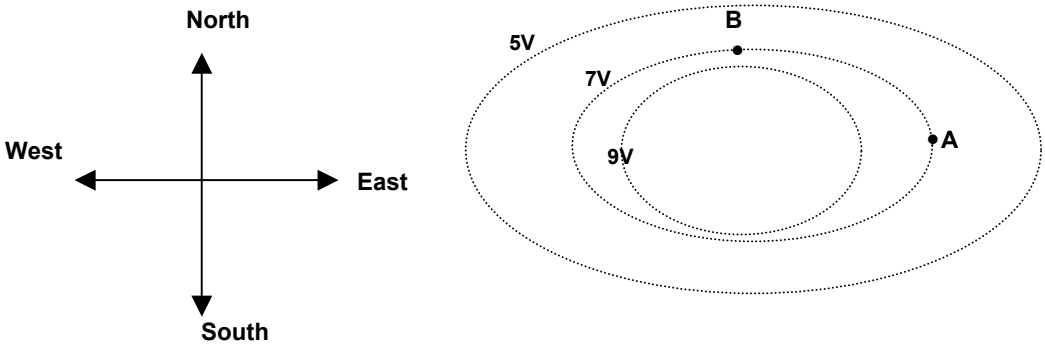
3. If R_1 is replaced by a ***larger*** resistance, then:
   A. ΔV_{AB} will increase
   B. ΔV_{AB} will decrease
   C. ΔV_{AB} will remain zero
   D. ΔV_{AB} will stay constant, but not zero

4. If R_1 is replaced by a ***larger*** resistance, then:
   A. I_2 will increase
   B. I_2 will decrease
   C. I_2 will remain zero
   D. I_2 will remain constant, but not zero

5. Source charge Q is fixed in position, and charge q is 5 m away from Q. The initial potential energy of q is 40 J. How much energy is required for you to push the charge q to a final distance of 4 m from Q, starting from the original location? (The charge starts at rest, and ends up at rest.)

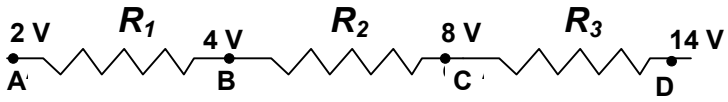
   A. 10 J
   B. 20 J
   C. 30 J
   D. 40 J
   E. 50 J
   F. 60 J
   G. 90 J
   H. 120 J
   I. 180 J

6. A set of equipotential lines is shown below. The magnitude of electric force on a +2-C charge at point A is 6 N. Which of these might correctly describe the magnitude and direction of the force on that same charge when placed at point B?



A. 18 N north
B. 18 N south
C. 18 N east
D. 18 N west
E. 6 N north
F. 6 N south
G. 6 N east
H. 6 N west
I. 2 N north
J. 2 N south
K. 2 N east
L. 2 N west

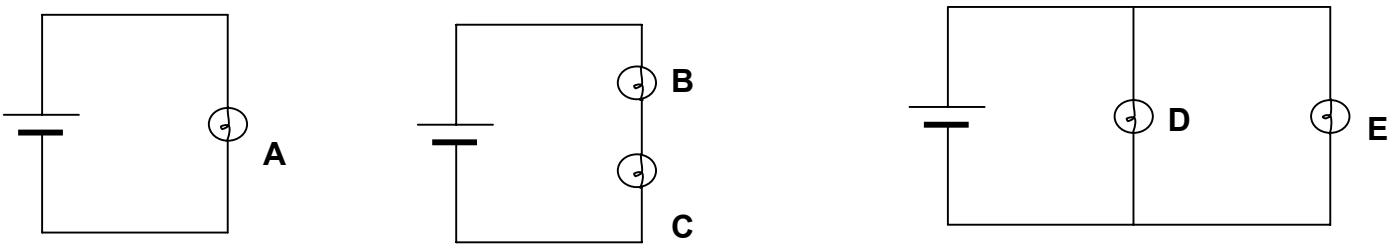
A section of a circuit is shown below; there is a steady flow of current in this circuit. The potential is indicated at the points A, B, C and D.



7. If R_3 is a 2-ohm resistor, then how much current is flowing past point B?

A. 1 A
B. 2 A
C. 3 A
D. 4 A
E. 6 A
F. 7 A
G. 12 A
H. 16 A
I. 28 A
J. There is not enough information to determine the current flowing past point B.

8. *[4 points]* All of the bulbs in these three circuits are identical (same resistance), and all three batteries are the same (same battery voltage).



Rank, in order, the following current magnitudes:

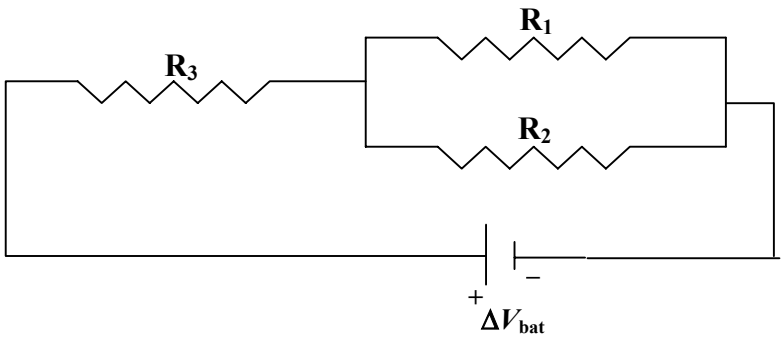
A. I_A: the amount of current flowing through bulb A
B. I_B: the amount of current flowing through bulb B
C. I_C: the amount of current flowing through bulb C
D. I_D: the amount of current flowing through bulb D
E. I_E: the amount of current flowing through bulb E

Rank A, B, C, D, and E, starting with the largest magnitude; if two or more are the same, put an "equals" sign ("=") between them, e.g., [A, B=C, D, E] means: A is largest, E is smallest, and B is equal to C.

9. *[2 points]* Explain the reasoning for your answer to #8 above. Use words, not math symbols.

10. *[six points]* Consider the following circuit: ***[Note that the resistances are not all equal]***

$R_3 = 5\ \Omega$
$R_1 = 5\ \Omega$
$R_2 = 10\ \Omega$



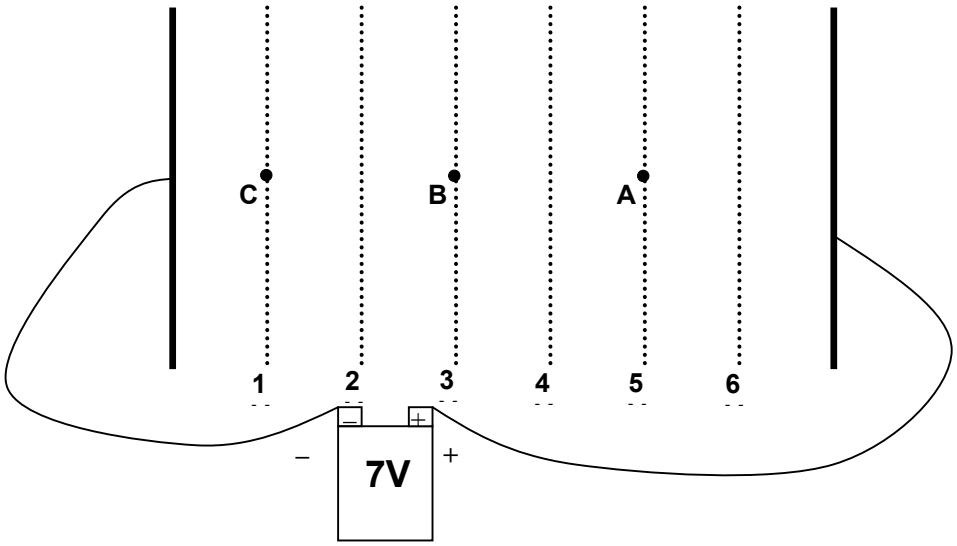
A) What is the correct ranking (largest to smallest) of currents I_{R1}, I_{R2} and I_{R3} for the circuit shown above?

B) Is ΔV_{R3} *larger than, smaller than,* or *equal to* ΔV_{R1} ?

C) Express ΔV_{bat} in terms of ΔV_{R1}, ΔV_{R2} and ΔV_{R3}. You do not need to use all three ΔV_R's in your expression. (There may be more than one way to do this.)

11. *(six points)* Two positive source charges of equal magnitude are shown. Draw arrows on the figure to represent the ***net*** electric field at points A, B, and C. (There are no charges at these points, just empty space.) Make sure the arrows correctly represent the relative magnitudes of the three electric field vectors (not ***exactly,*** but enough to see which is larger than which). If the electric field at a point is zero, write "***zero***" at that point. ***IMPORTANT: ONLY*** DRAW ARROWS REPRESENTING THE ***NET*** ELECTRIC FIELD AT THOSE POINTS!!

12. *[4 points]* Two large parallel conducting plates are connected to a battery as shown. ***Assume the potential at the negative terminal of the battery is zero volts.*** Suppose a positively charged particle is shot from a gun that is located on the left-side plate, but is pointed toward the right side.



After leaving the gun, the particle heads toward the right side, passing first through position C, then position B, and then position A. On the Answer Sheet, complete the bar graph to show the kinetic energy (KE) of the particle at A, B, and C, and the electric potential energy (PE) of the particle at A, B, and C. The kinetic energy at C (KE_C) and the electric potential energy at C (PE_C) are already shown; you need to draw four additional bars.

Physics 112
Exam #2 ANSWER SHEET
October 22, 1999

Name: _____

1. _____ ***Grade out of 4.5? Mark "X" here:*** _____

2. _____ ***Grade out of 4.5? Mark "X" here:*** _____

3. _____ ***Grade out of 4.5? Mark "X" here:*** _____

4. _____ ***Grade out of 4.5? Mark "X" here:*** _____

5. _____ ***Grade out of 4.5? Mark "X" here:*** _____

6. _____ ***Grade out of 4.5? Mark "X" here:*** _____

7. _____ ***Grade out of 4.5? Mark "X" here:*** _____

8. Ranking: (largest) _____(smallest)

9. [*Explanation:*]

10.

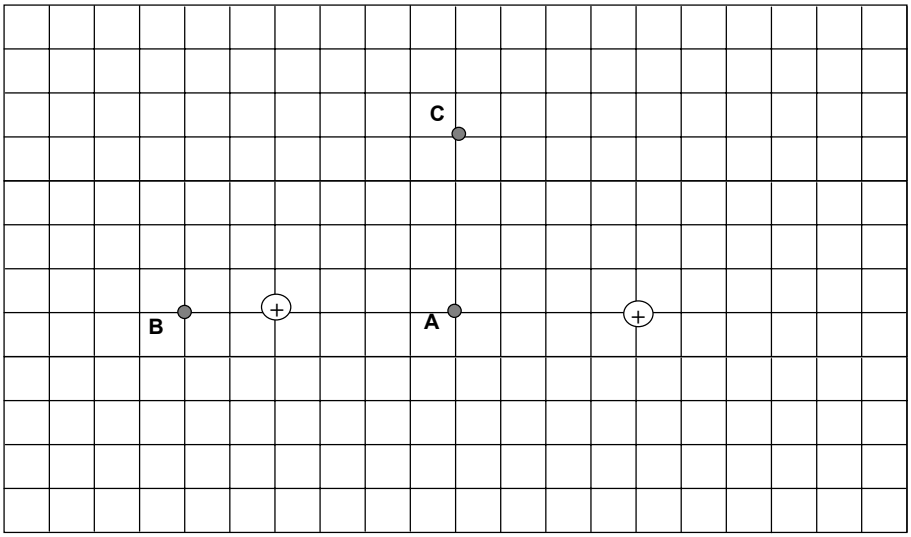
A)

B)

C)

Name: _____

11.



12.