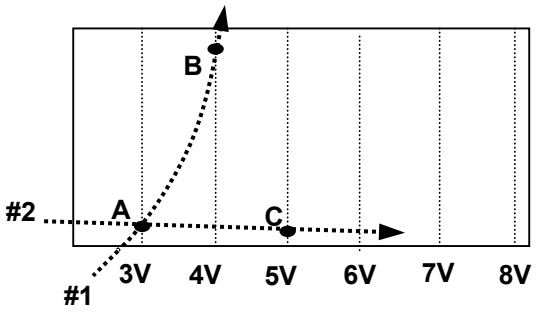
Physics 112
Exam #2
October 20, 2000
Name: _____

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

#1-7 are NO PARTIAL CREDIT; 3 points each. If you want one of them graded out of 3.5 points (–1 [<u>minus one</u>] for wrong answer!!!) mark the indicated box on the Answer Sheet with an "X." (No extra credit option for #1, 3 or 5.) #8-12 require short answers, rankings, or explanations. <u>Record everything on the answer sheet.</u> Points indicated for each question.
Total: 50 points

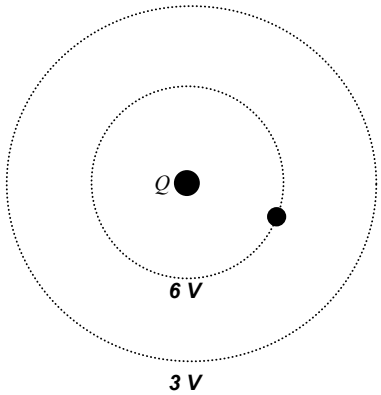
1. A positive charge *q* is shot into a region in which there is a uniform electric field (see diagram). First, it is shot along path #1; then it is shot in again along path #2. ***CHOSE TWO CORRECT STATEMENTS (half credit for each).***

   A. It gains kinetic energy while traveling inside this region.
   B. It loses kinetic energy while traveling inside this region.
   C. Its kinetic energy is constant while traveling inside this region.
   D. The kinetic energy change from [A to B] is ***greater than*** the kinetic energy change from [A to C].
   E. The kinetic energy change from [A to B] is ***less than*** the kinetic energy change from [A to C].
   F. The kinetic energy change from [A to B] is ***the same as*** the kinetic energy change from [A to C].



2. A charge *Q* is fixed at the origin. An object with mass 3 kg and charge 9 C is held motionless on the 6-V equipotential circle (a distance *r* from the origin), and then released. (See diagram.) Which of these will be closest to the velocity attained by the object when it is ***very far*** (more than 1,000 *r)* from the origin?

   A. 0 m/s
   B. 2 m/s
   C. 3 m/s
   D. 4 m/s
   E. 6 m/s
   F. 36 m/s
   G. 54 m/s



3. You are told to go into a room and measure the electric field magnitude at a point one meter from the center of the room. The room is completely empty. (The source charges producing the field are somewhere outside; assume that these source charges don't move or change in any way.) You use a test charge and measure the electric field magnitude one meter from the center of the room to be "E." When you leave, taking your test charge with you, someone else comes in and measures the field at the ***same*** location using a different test charge, one which has ***twice*** the charge of your own. The electric ***field*** magnitude that they will measure will be:

   A. 0.25 E
   B. 0.5 E
   C. E
   D. 2 E
   E. 4 E
   F. There is not enough information to answer this question.

4. Two identical resistors are connected in series to a battery. The power supplied by the battery in this case is $\mathbf{P}_{\text{series}}$. If the two resistors are instead connected to the same battery in parallel, the power supplied by the battery is $\mathbf{P}_{\text{parallel}}$. Then:

   A. $\mathbf{P}_{\text{parallel}} = 4\ \mathbf{P}_{\text{series}}$
   B. $\mathbf{P}_{\text{parallel}} = 2\ \mathbf{P}_{\text{series}}$
   C. $\mathbf{P}_{\text{parallel}} = \mathbf{P}_{\text{series}}$
   D. $\mathbf{P}_{\text{parallel}} = 1/2\ \mathbf{P}_{\text{series}}$
   E. $\mathbf{P}_{\text{parallel}} = 1/4\ \mathbf{P}_{\text{series}}$

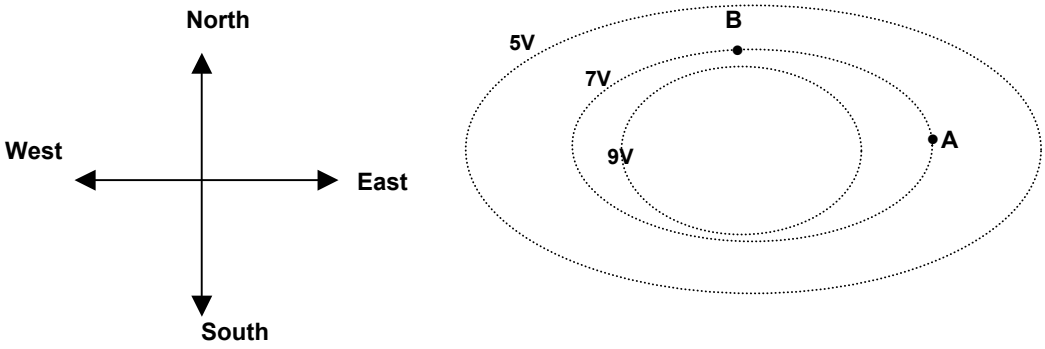
5. Two parallel metal plates are connected to a battery. A positively charged particle is released from rest on the positive plate and it drifts toward the negative plate, speeding up as it goes. As it moves, the magnitude of the force acting on it will:

   A. decrease as it moves toward the midpoint, then increase as it approaches the negative plate.
   B. increase as it moves toward the midpont, then decrease as it approaches the negative plate.
   C. steadily decrease as it moves away from the positive plate.
   D. steadily increase as it approaches the negative plate.
   E. neither increase nor decrease as it moves from one plate to the other.
   F. decrease as it approaches the midpoint, remain constant for a while, then increase again as it approaches the negative plate.

6. A three-ohm resistor and a four-ohm resistor are connected in series to a battery. In a separate circuit, a three-ohm resistor and a four-ohm resistor are connected in parallel to a battery with the ***same*** battery voltage as in the first circuit. Which resistor will have the ***largest potential drop*** across it (i.e., the largest potential difference between its ends)?

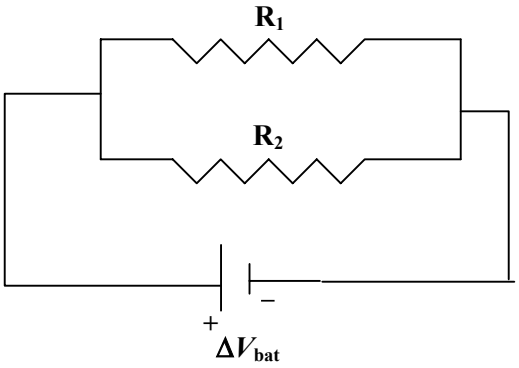
   A. The three-ohm resistor in the series circuit.
   B. The four-ohm resistor in the series circuit.
   C. The three-ohm resistor and the four-ohm resistor in the series circuit, which have the ***same*** potential drop.
   D. The three-ohm resistor in the parallel circuit.
   E. The four-ohm resistor in the parallel circuit.
   F. The three-ohm resistor and the four-ohm resistor in the parallel circuit, which have the ***same*** potential drop.

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



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

Question #8 refers to the following circuit:



8. *[six points]* Suppose R_1 is replaced by a ***larger*** resistance, and consider the following ***nine*** quantities:

ΔV_1, ΔV_2, ΔV_{bat}, I_1, I_2, I_{tot}, P_1, P_2, P_{bat},

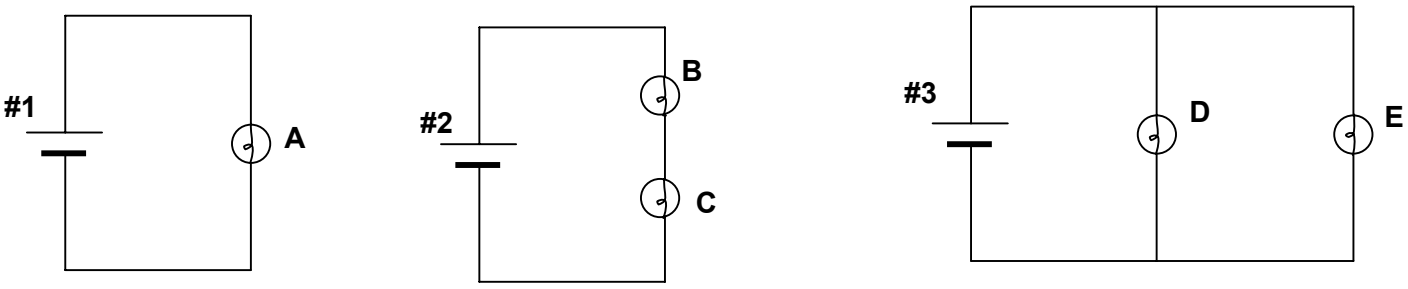
A. Which of these will ***increase***?
B. Which of these will ***decrease***?
C. Which of these will ***remain the same***?

9. *[3 points]*

A. What quantity related to an ideal battery will be the ***same*** no matter what circuit it is connected to, and no matter how that circuit is wired up?

B. What quantity related to an ideal battery may be ***different*** depending on what circuit it is connected to?

10. *[9 points]* Three separate circuits are shown here. All of the bulbs are identical to each other (same resistance), and all three batteries are also identical (same voltage).



A. *[2 pts]* Rank the ***brightness*** of the five bulbs, from brightest to dimmest: e.g., A > B > C > D > E means bulb "A" is the brightest, then B, etc. If two or more bulbs are *equally* bright, indicate that with an "=" sign. (E.g., A = B = C = D = E means that all bulbs are equally bright, etc.)

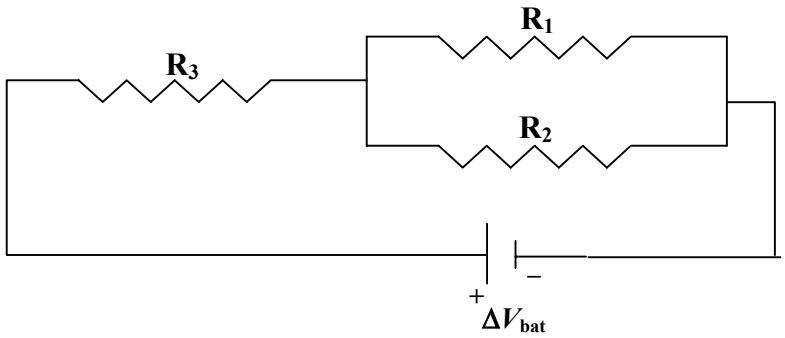
B. *[3 pts]* ***Making use of the answer you gave for question (A),*** rank the ***amount of current flowing*** through the three ***batteries*** (#1, #2, and #3), from most to least.

C. *[2 pts]* ***Explain*** the reasoning you used to answer part (B), making reference to the brightness of the bulbs.

D. *[2 pts]* Rank the ***energy provided each second*** by the three batteries, from most to least. Again, if two or more are equal, indicate that with an "=" sign.

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

$R_3 = 5\ \Omega$
$R_1 = 40\ \Omega$
$R_2 = 120\ \Omega$



A. *[1pt]* What is the correct ranking (largest to smallest) of currents I_{R1}, I_{R2} and I_{R3} for the circuit shown above?

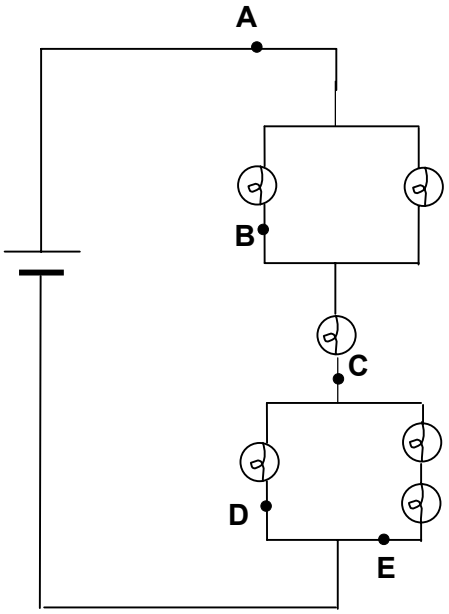
B. *[1 pt]* $\dfrac{\Delta V_{R1}}{\Delta V_{R2}} = ?$

C) *[2 pts]* $\dfrac{I_{R1}}{I_{R2}} = ?$

D) *[1.5 pts]* Is ΔV_{R3} *larger than, smaller than,* or *equal to* ΔV_{R2} ?

E) *[1.5 pts]* $\dfrac{\Delta V_{R2}}{\Delta V_{R3}} = ?$

12. *[4 points]* Consider the following circuit, in which all bulbs are ***identical***:



In this circuit, rank the *amount of current* flowing past the five points A, B, C, D and E. e.g., A > B > C > D > E means the most current flows past point "A," etc. If the currents flowing past one or more of the points are equal, indicate that with an "=" sign.

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1. _____ ; _____
2. _____ ***Grade out of 3.5? Mark "X" here:*** _____
3. _____
4. _____ ***Grade out of 3.5? Mark "X" here:*** _____
5. _____
6. _____ ***Grade out of 3.5? Mark "X" here:*** _____
7. _____ ***Grade out of 3.5? Mark "X" here:*** _____

8.

A. _____

B. _____

C. _____

9.

A. _____

B. _____

Name: _____

10.

A. Brightest _____Dimmest

B. Most current _____ Least current

Note: *Answers to B are numbers, i.e., #1, #2, and #3.*

C. *[explanation]*

D. Most energy per second _____Least energy per second

Note: *Answers to D are numbers, i.e., #1, #2, and #3.*

11.

A. _____

B. _____

C. _____

D. _____

E. _____

12. Most Current: _____ Least Current