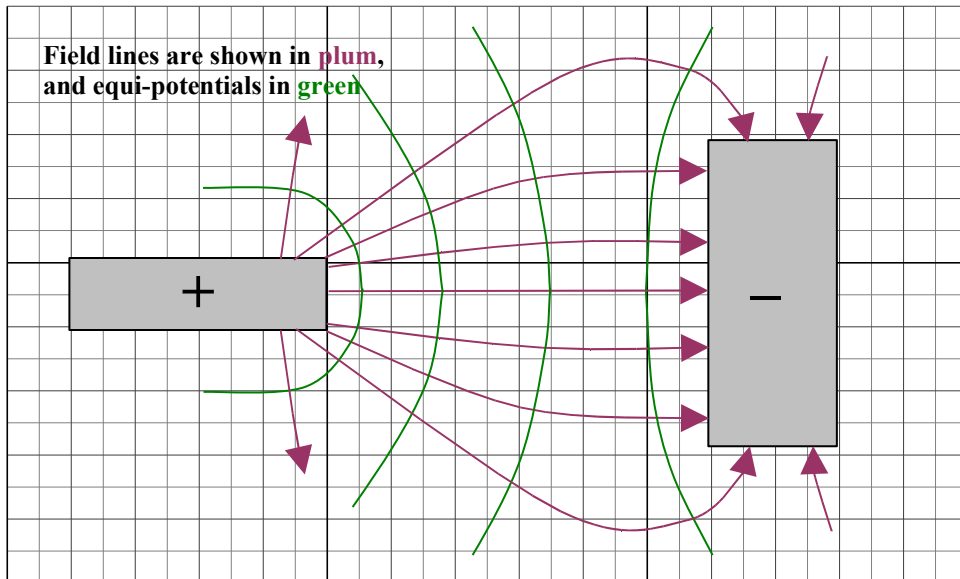


Quiz # 1
Physics 222, Section 002
Jan. 27, 2006

1. Suppose you have three resistors of resistances R_1 , R_2 , and R_3 such that $R_1 < R_2 < R_3$. If the three resistors are connected in parallel to a battery that gives out some constant voltage V , and if we label the voltage drops across the given resistors by V_1 , V_2 , and V_3 , respectively, and the currents by I_1 , I_2 , and I_3 , respectively, then **one or more** of the following describes the situation:
 - (a) The voltage drops satisfy the following inequality: $V_1 < V_2 < V_3$.
 - (b) The voltage drops satisfy the following inequality: $V_1 > V_2 > V_3$.
 - (c) The currents satisfy the following inequality: $I_1 < I_2 < I_3$.
 - ✓ (d) The currents satisfy the following inequality: $I_1 > I_2 > I_3$.
 - ✓ (e) The voltage drops satisfy the following equality: $V_1 = V_2 = V_3$.
 - (f) The currents satisfy the following equality: $I_1 = I_2 = I_3$.

2. The figure below shows the set up you used last time to do the *Electric Fields Experiment*. From the information available in the figure, draw a few **representative** equi-potentials (5 or 6), and use them to construct field lines. Use small arrows to show direction.



Explanation of Solution

1. (2.5 point per choice) Since all resistors are connected in parallel, the following must hold:

$$\boxed{V_1 = V_2 = V_3}$$

which is why answer (e) is true. Now we look at the given relation between the three resistances:

$$R_1 < R_2 < R_3$$

But this is equivalent to the following:

$$\frac{1}{R_1} > \frac{1}{R_2} > \frac{1}{R_3}$$

Now, we know that in general $I = V/R$, therefore, by multiplying the above inequality by V , we get:

$$\frac{V}{R_1} > \frac{V}{R_2} > \frac{V}{R_3} \Leftrightarrow \boxed{I_1 > I_2 > I_3}$$

which is why (d) is true. All other choices are false as they are incompatible with the two correct ones.

2. (5 Points) Here are the rules that were used to draw electric field lines (the green lines ending in arrows), and the equi-potential lines (the plum lines):

- An electric field line must start from a positively charged object and end in negatively charged one, and be drawn smoothly.
- Field lines are perpendicular to the surfaces of the charged objects from they originate and those at which they end.
- Field lines must not intersect.
- Equi-potential are always perpendicular to field lines, and are drawn smoothly.
- Equi-potentials must not intersect.