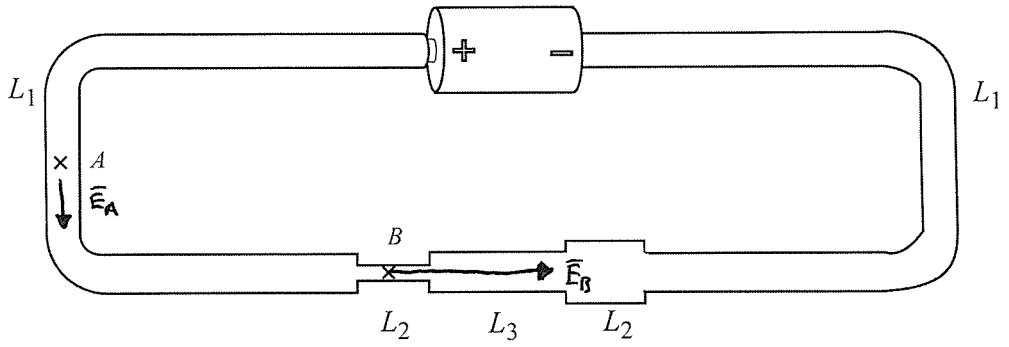
Physics 2212 Spring 2014 Lab Quiz #4

Name: Key Section: _____

Show all work clearly and in order, and box your final answers.

All of the wires in the circuit shown in the diagram are made of the same material. Two pieces of wire (of length L_2) have a different radius than the other pieces (of length L_1 and L_3).



1. (*40 points*) Which of the following statements are true of this circuit in the steady state?

Circle all that apply.

- The magnitude of the electric field is the same at each location labeled by a letter.
- The electric field at location A points up.
- (•) The electric field at B is larger in magnitude than the electric field at A.
- The electric field at A is larger in magnitude than the electric field at B.
- (•) The electron current in this circuit is less than the electron current would be if all the wires were thick.
- The electron current in this circuit is more than the electron current would be if all the wires were thick.
- (•) The number of electrons passing location B each second is the same as the number of electrons passing location A each second.
- The number of electrons passing location B each second is the less than the number of electrons passing location A each second.
- (•) At every location inside any piece of the wire, the direction of the electric field is parallel to the wire.

(Continued on the back)

2. (*20 points*) The radius of the thin wire is 0.2 mm and the radius of the fat wire is 0.6 mm. The wires of length L_1 and L_3 have a radius of 0.4 mm. There are 4×10^{28} mobile electrons per cubic meter of this material, and the electron mobility is 0.0006 (m/s)/(V/m). If 5×10^{18} electrons pass location B each second, how many electrons pass location A each second?

$i_B = i_A$ the # of electrons passing location B each second is the same as the # of electrons passing location A each second

$i_A = 5 \times 10^{18} \frac{\text{electrons}}{\text{second}}$

3. (*20 points*) On the diagram, at location A, draw the direction of the net electric field. What is the magnitude of the electric field at location A?

$i_A = nA_A\bar{v}_A = nA_A u E_A \Rightarrow E_A = \frac{i_A}{nA_A u} \Rightarrow |E_A| = 0.4145 \frac{N}{C}$

4. (*20 points*) On the diagram, at location B, draw the direction of the net electric field. What is the magnitude of the electric field at location B?

$E_B = \frac{i_B}{nA_B u} \Rightarrow |E_B| = 1.66 \frac{N}{C}$