Name ____ Date ______________

PH 102 Quiz 4: Resistance is Futile

$\Delta V = IR \qquad I = v_d nqA \qquad R = \dfrac{\varrho l}{A}$

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1. When we power a light bulb, are we using up charges and converting them to light?

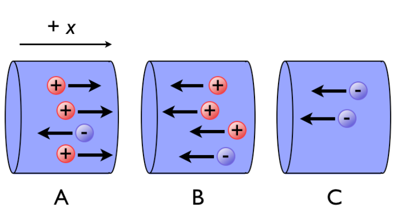
- ◯ Yes, charges moving through the filament produce "friction" which heats up the filament and produces light
- ◯ Yes, charges are emitted and observed as light
- ◯ No, charge is conserved. It is simply converted to another form such as heat and light.
- ◯ No, charge is conserved. Charges moving through the filament produce "friction" which heats up the filament and produces light.

2. The drift velocity of charges in a typical copper wire is very small, $\sim 10^{-3}\,\text{m/s}$. At this rate, it would take about 15 minutes after flipping the switch for your lights to come on. Why do your lights actually come on almost instantaneously?

- ◯ Charges are already in the wire. When the circuit is completed, there is a rapid rearrangement of surface charges in the circuit.
- ◯ Charges store energy. When the circuit is completed, the energy is released.
- ◯ Charges in the wire travel very fast
- ◯ The circuits in a home are wired in parallel. Thus, a current is already flowing

3. If you double the current through a resistor ...

- ◯ The potential difference doubles
- ◯ The potential difference is half
- ◯ The potential difference is the same
- ◯ None of the above



4. Rank the relative currents in figures a, b, and c from lowest to highest. Assume positive current corresponds to positive charges flowing to the right, and that all charges move at the same velocity.

- ◯ $a < b < c$
- ◯ $b < a < c$
- ◯ $c < b = a$
- ◯ $b < c < a$

5. Suppose a current-carrying wire has a cross-sectional area that gradually becomes smaller along the wire, so that the wire has the shape of a very long cone. How does the drift speed vary along the wire? *Hint - perhaps an equation above can help.*

- ◯ It slows down as the cross section becomes smaller
- ◯ It speeds up as the cross section becomes smaller
- ◯ It doesn't change
- ◯ More information is required