

Consider a tapered slab of aluminum, as drawn here. By "circle A" and "circle B," I mean the imaginary dashed circles through points A and B.

The ends of the slab are connected, by essentially resistanceless wires, to opposite terminals of a 1.5-volt battery.

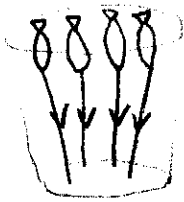
- Which electric current is bigger: the one through circle A, or the one through circle B? Or are they equally big? Explain your answer.
- Is the electric current *density* greater at the center of circle A or the center of circle B? Or are they equally big? Again, explain your answer.
- The current through circle A is 0.30 amps. What can you tell me about the resistive properties of the slab? Can you find its resistivity? Its resistance?

Calculate what you can, and explain why you *can't* calculate the other things.

Compare the resistivity of the slab near point A to its resistivity near point B. At which point, if either, is the resistivity greater? Hint: Don't get caught up in formulas. Think about what resistivity means.

(Challenge problem) Where is the electric field bigger; at the center of circle A or the center of circle B? Or is it equally big at both points? Explain your answer.

a) Current is $\frac{\text{charge}}{\text{time}}$... for a steady flow of charge, must have $I_A = I_B$ (charges cannot build up)

b)  Imagine fish swimming ... if they don't pile up, they have to get closer together $\Rightarrow J_B > J_A$

c) $I_A = 0.3A$ What is ρ ? ρ (resistivity) is a property of the material ... we can't say much about it (would have to look it up)

We can, however, calculate $R = \frac{V}{I}$ from ohm's Law

$$R = 1.5/0.3 = \underline{\underline{5 \Omega}}$$

d) The resistivity is a property of the material $\Rightarrow \rho_A = \rho_B$

e) $E = J\rho$... for bigger J , field must "work harder" $\Rightarrow E_B > E_A$