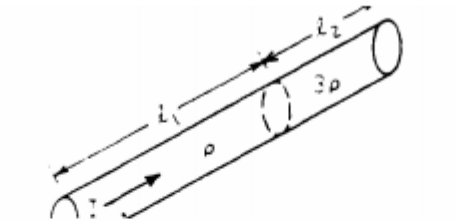
I. The problem statement, all variables and given/known data



1977E2. A resistor is made in the form of a cylinder of cross-sectional area A. One portion, of length l_1 is made of material whose resistivity is ρ, the other of length l_2 is made of material whose resistivity is 3ρ. There is a current I uniformly distributed over the area A. Express all answers in terms of fundamental constants and the symbols shown in the diagram above.

a. Determine expressions for the electric field strengths E_1 and E_2 in the two portions of the resistor.
b. Determine the potential difference V between the opposite ends of the resistor.
c. By applying Gauss's law to a surface which encloses the boundary between the two materials, determine the sign and magnitude of the electric charge which is present on this boundary.

Hello, everyone. My question is about part c of this question, and particularly, I am trying to understand why the solutions solve it in a certain way. The official solutions to part C is:

c) 5 points

$\int \vec{E} \cdot d\vec{S} = q/\epsilon_0$ 2

(Other units also given credit)

$(E_2 - E_1) A = q/\epsilon_0$ 1

$q = 2I\rho\epsilon_0$ 1

Positive 1

This is all that the solutions say.

II. Relevant Equations

Since the problem mentions Gauss's law, I think I will use that.
I also know that Resistance = resistivity * (length/Area).
Also, J = I/A

III. The Attempt at a Solution

So my problem is understanding why they solved it a certain way, to determine the "sign and magnitude of the electric charge which is present on this boundary." The problem is that I know that there is an electric current traveling through the cylinder, so there is no fixed charge staying on the boundary between two materials as the charges are moving through the cylinder. Thus, how is it possible to apply Gauss's law to this surface to get the fixed amount of a charge on this boundary? And if it is possible, then why did they in the solutions use this approach to solve it?

Thanks in advance for the help, and make it a great day!