These are the dynamic Maxwell equations

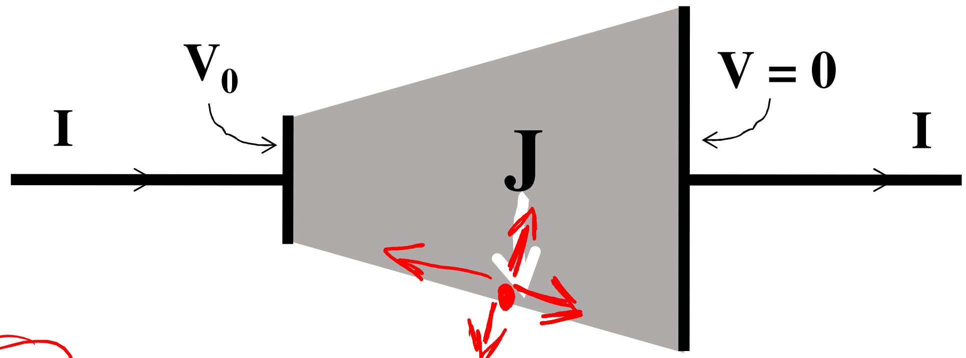
$$\nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0} \qquad \nabla \cdot \vec{B} = 0$$

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \qquad \nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t}$$

What can I do to make them be the dynamic Maxwell equations *in matter*?

A) Leave them alone, but attend carefully to what ρ and J are. 6
B) Replace the ε_0 and μ_0 with ε and μ, and let the sources be free sources. 0
C) Make a variety of substitutions involving ε, μ, H, and D. 2
D) A and C 27
E) A, B, and C 7

Inside this resistor setup, what can you conclude about the current density **J** near the side walls?



A) Must be exactly parallel to the wall 18

B) Must be exactly perpendicular to the wall 3

C) Could have a mix of parallel and perpendicular components 21

D) No obvious way to decide

Let's get some more perspective on the previous. Starting from the continuity equation for current, $\nabla \cdot \vec{J} = -\frac{\partial \rho}{\partial t}$, derive a general boundary condition on the perpendicular component of J.

A) $J_{perp,1} - J_{perp,2} = 0$

B) $J_{perp,1} - J_{perp,2} = -\frac{\partial \rho}{\partial t}$

C) $J_{perp,1} - J_{perp,2} = -\frac{\partial \sigma}{\partial t}$

D) $J_{perp,1} - J_{perp,2} = -\rho$

E) Something else

Let's make use of that here.