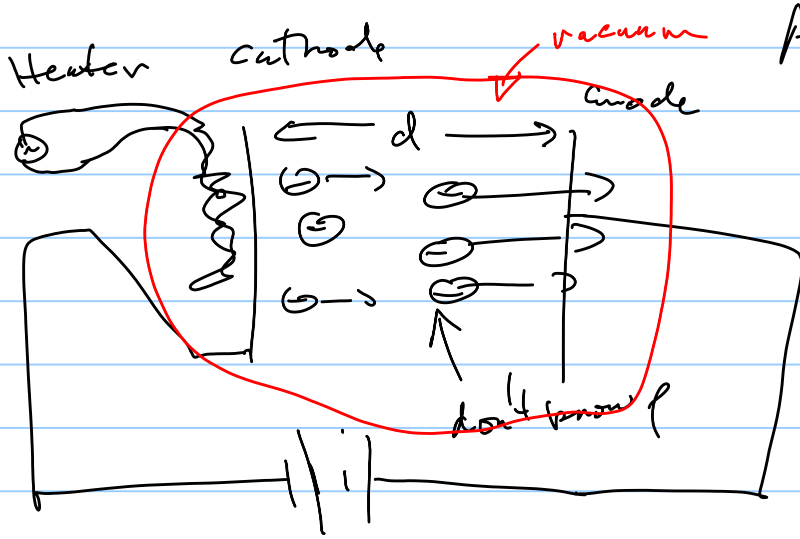
Note Title 4/22/2009



Assume 1D motion

Find E ?

V ?

I ?

ρ ?

$\vec{E} = -\vec{\nabla} V$

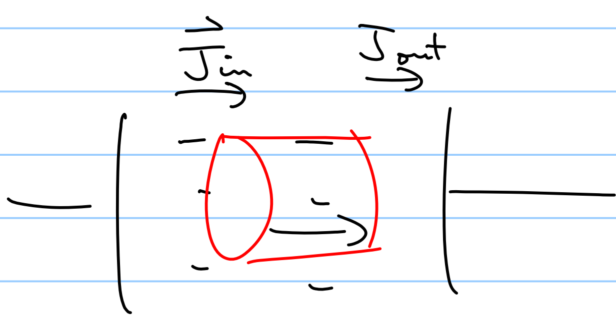
$$\vec{\nabla}\cdot\vec{E} = \rho/\epsilon_0 \qquad \nabla^2 V = -\rho/\epsilon_0$$

Newtons laws $\quad \vec{F} = m\vec{a} = q\vec{E} + q\vec{v}\times\vec{B}$

Conservation of Energy

$$\Delta(KE + \underbrace{PE}_{= q\Delta V}) = \cancel{W_{nc}} \to 0$$

Cons charge $\quad \vec{\nabla}\cdot\vec{J} = -\cancel{\frac{\partial \rho}{\partial t}} \to 0$ steady state



$J_{in} = J_{out}$

$\rho_{in} v_{in} = \rho_{out} v_{out}$

$B \Rightarrow q\vec{v}\times\vec{B}$ $\qquad$ $\vec{\nabla}\times\vec{B} = \mu_0\vec{J} + \mu_0\vec{J}_D$

$\downarrow$

amps Biot-Savart

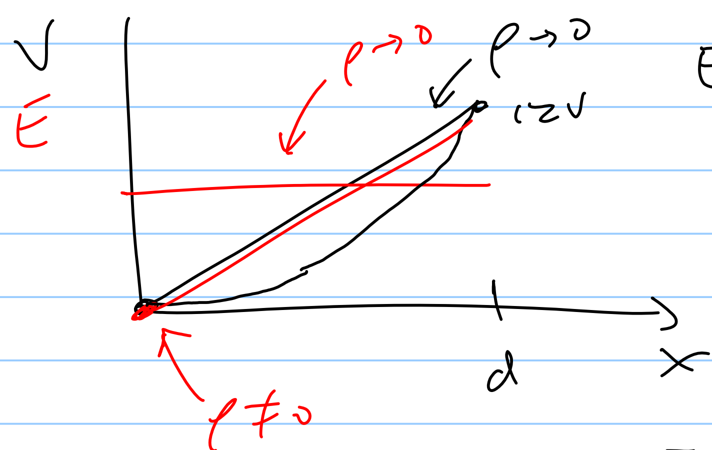
Neglect B to simplify the problem

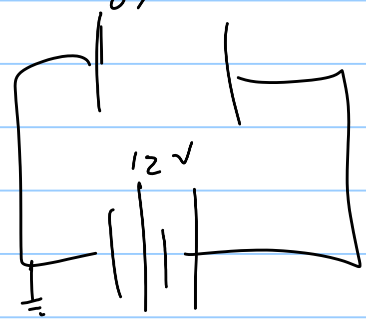
Relativity $\qquad$ Neglect

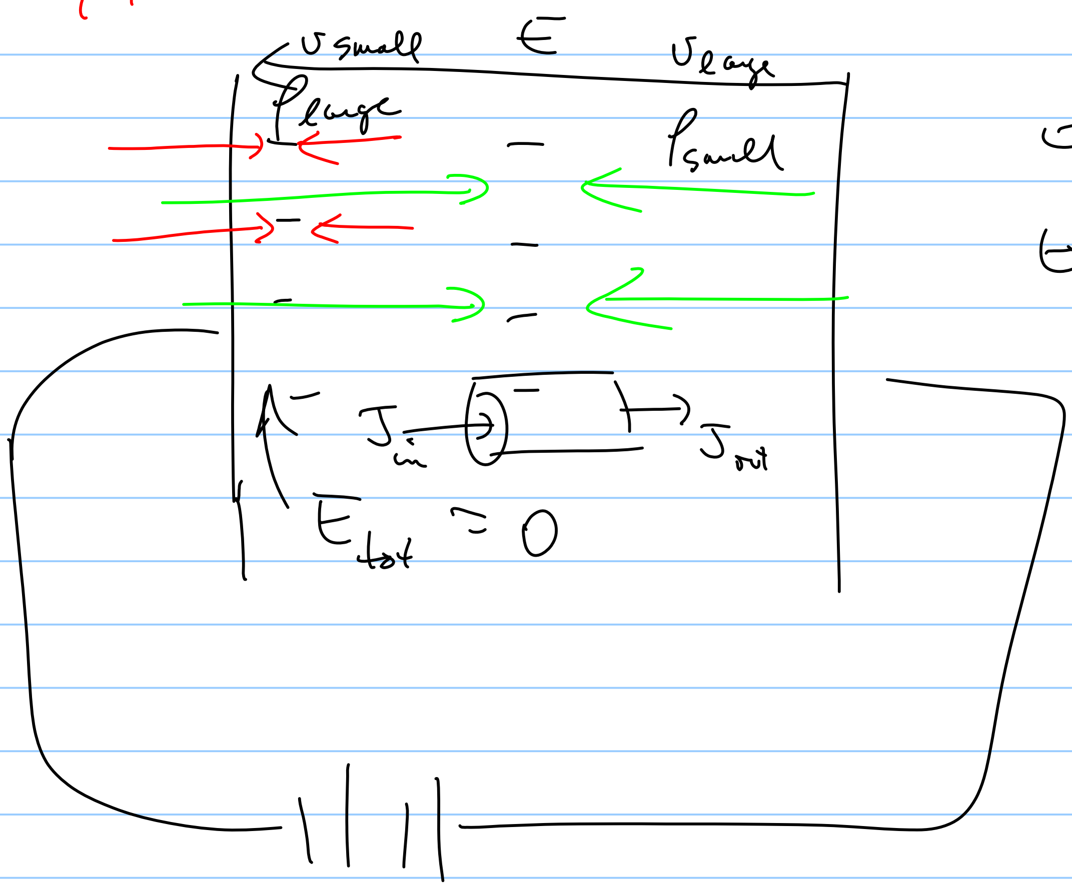
How would you check your ans?

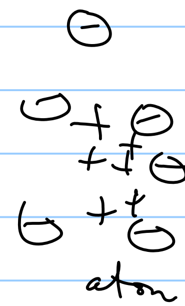
Turn heater down & what are effects?

$E = -\vec{\nabla}V = -\frac{\partial V}{\partial x} = 0$









1.) $\nabla^2 V(x) = -\frac{\rho(x)}{\epsilon_0}$

$$\boxed{\frac{d^2V}{dx^2} = -\rho(x)/\epsilon_0}$$

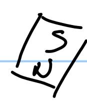
$\int J \cdot da = I$

2.) $$\boxed{\rho(x)\, v(x) = \text{const} = \frac{I}{\text{Area}}}$$

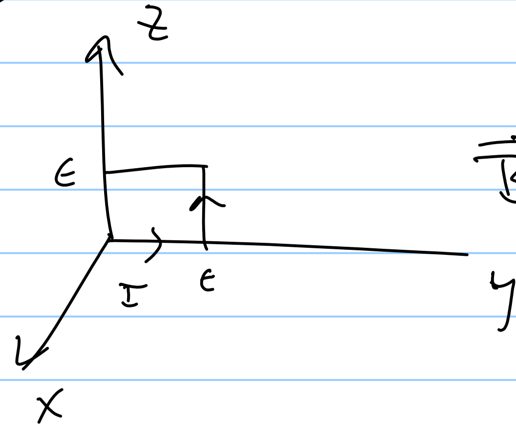
3.) F = ma or cons energy $(KE+PE)_i = (KE+PE)_f$

$$\boxed{\frac{1}{2} m v^2 = q V(x)}$$

at $x = 0$ $v = 0$



find Force of one on other



ε is small

$\vec{B} = B_x(x,y,z)\hat{x} + B_y(x,y,z)\hat{y} + \hat{z}$

4 $d\vec{\ell}$'s

$d\vec{F} = I\, d\vec{\ell} \times \vec{B}$

lower right

$= I\{\, dy\,\hat{y} \times \vec{B}(0,y,0) + dz\,\hat{z} \times \vec{B}(0,\epsilon,z)$

$$\overset{\text{upper}}{-}\, dy\, \hat{y} \times \vec{B}(0, y, \epsilon) - dz\, \hat{z} \times \vec{B}(0, 0, z) \Big\}$$

+ ξ, limits different