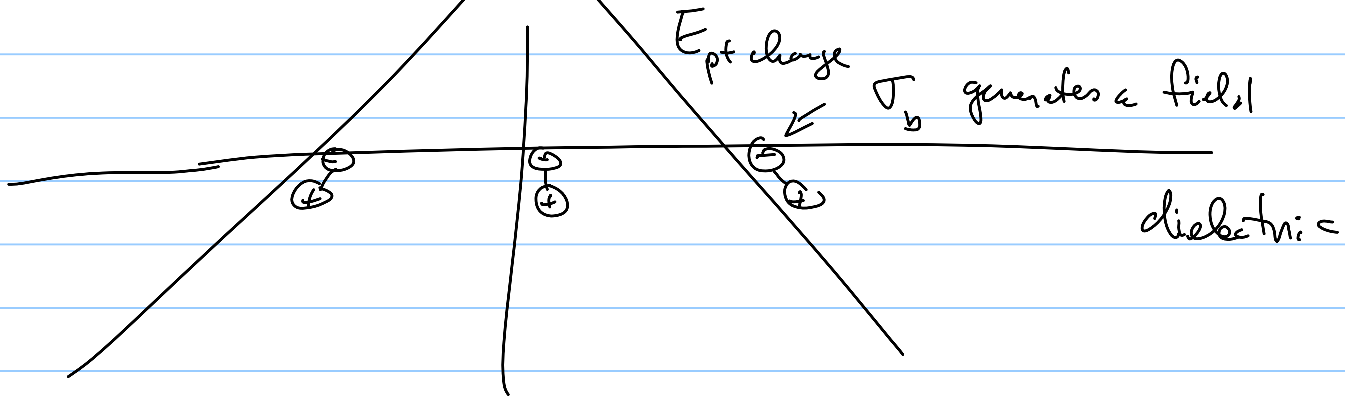
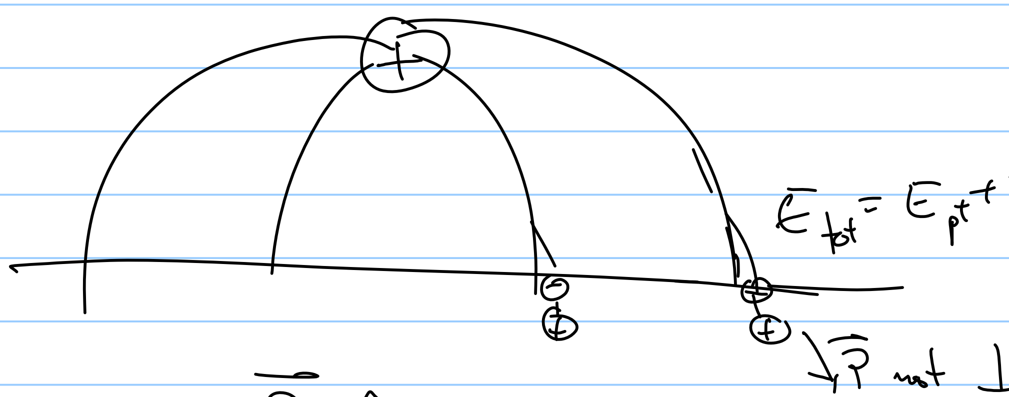
Note Title 3/18/2009

$\vec{P} = \epsilon_0 \chi_e \vec{E}$




$\vec{E}_{tot} = E_{pt} + E_{bound\ charge}$

$\sigma_b = \vec{P} \cdot \hat{n}$

$\rho_b = -\vec{\nabla} \cdot \vec{P} = -\vec{\nabla} \cdot \epsilon_0 \chi_e \vec{E}_{tot} = -\epsilon_0 \chi_e \vec{\nabla} \cdot \vec{E}_{tot}$

($\epsilon_0 \chi_e$: don't depend on x, y z)

($\epsilon_0 \chi_e \vec{E}_{tot}$ = $\vec{D}/\epsilon$)

$\vec{D} = \epsilon \vec{E}_{tot}$

$\vec{\nabla} \cdot \vec{E} = \rho/\epsilon_0 = \dfrac{\rho_f}{\epsilon_0} + \dfrac{\rho_b}{\epsilon_0}$

($\rho_b = -\vec{\nabla} \cdot \vec{P}$)

$\vec{\nabla} \cdot \underbrace{(\epsilon_0 \vec{E} + \vec{P})}_{\vec{D}} = \rho_f$

$$\rho_b = -\vec\nabla\cdot\vec P = -\frac{\epsilon_0 \chi_e}{\epsilon}\vec\nabla\cdot\vec D = -\frac{\epsilon_0}{\epsilon}\chi_e \rho_f$$

$\rho_f = 0$ inside glass

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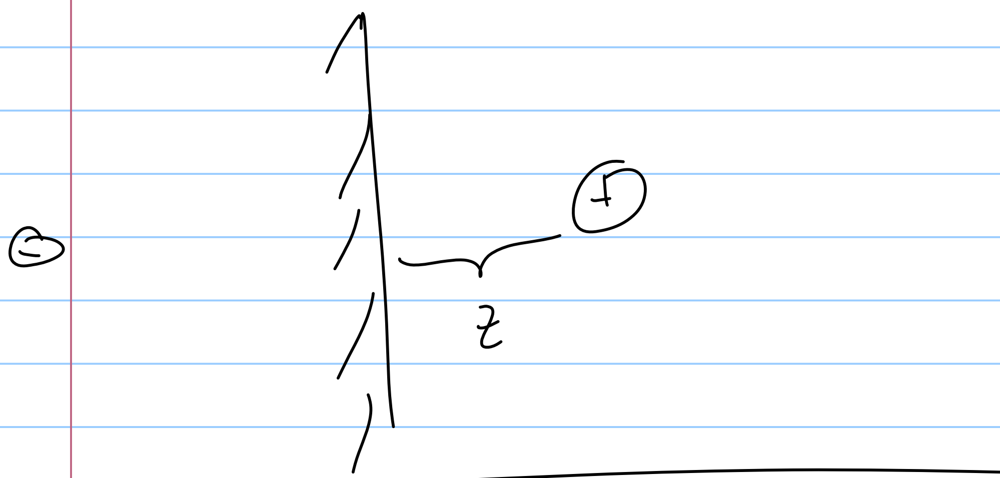
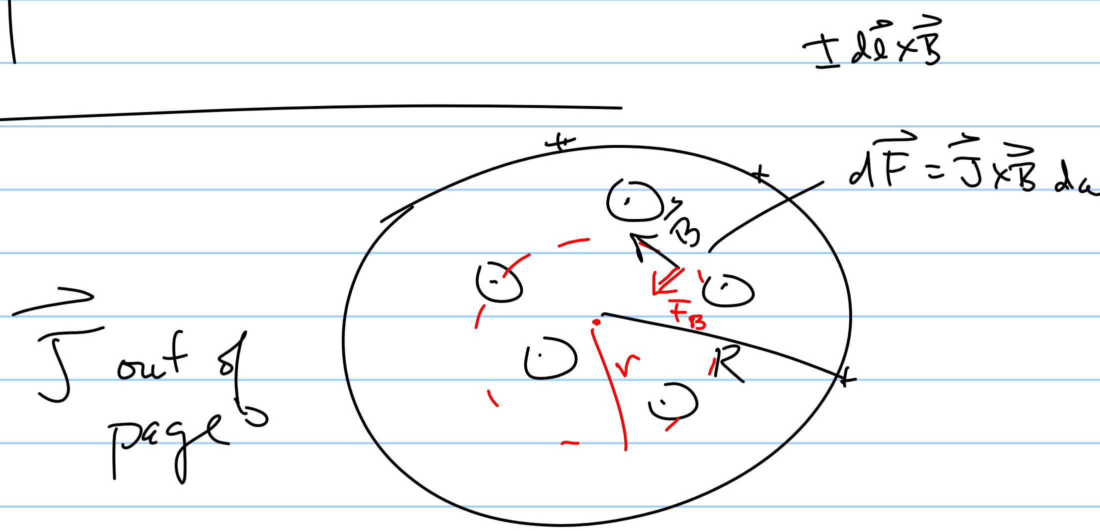



Tablet Q




Principles: $\vec F = q\vec E + q\,\vec v\times\vec B$

$\frac{C}{m^3}\,\frac{m}{s} \rightarrow \frac{\text{Amps}}{m^2}$

Method: Find B & $\vec E$

$$\oint \vec B\cdot d\vec\ell = \mu_0\int \vec J\cdot d\vec a = \mu_0\int \rho\,\vec v\cdot d\vec a$$

$$B\,2\pi r = \mu_0\int \rho(r)\,\vec v(r)\cdot d\vec a$$

Contraction of current toward center of wire leads to E

In steady state

$$q\vec{v}\times\vec{B}+q\vec{E}=0$$

$$\boxed{\vec{E}(r) = -\vec{v}(r)\times\vec{B}(r)}$$

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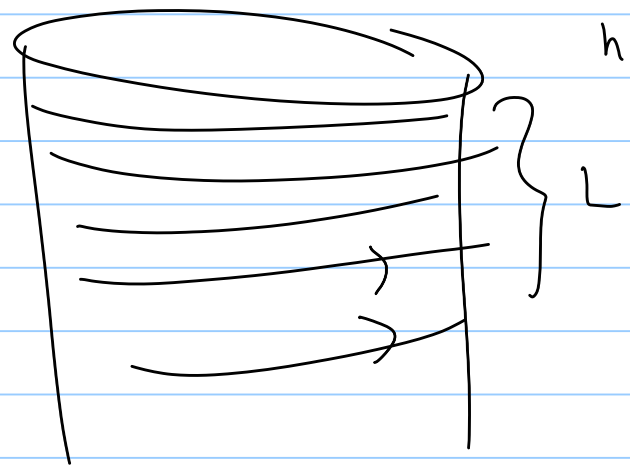
tablet Q

each wire carries $I_0$




What is B inside solenoid

$$\oint \vec{B}\cdot d\vec{\ell} = \mu_0 I_{enc}$$

wires in a plane

$$d\vec{B} = \mu_0 \frac{I\,d\vec{\ell}\times\hat{r}}{r^2}$$