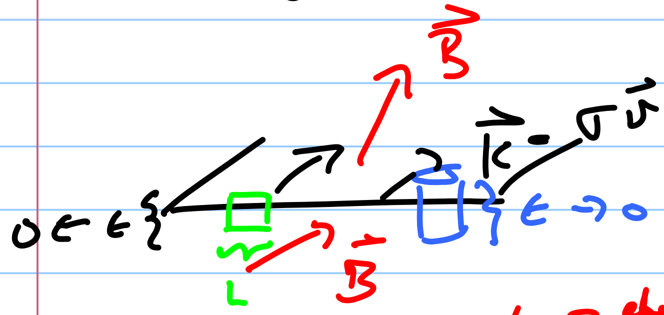
Note Title 3/28/2008

Bndry conditions on $\vec{B}$ & $\vec{A}$



$$\boxed{\vec{\nabla}\cdot\vec{B} = 0}$$

$$\int \vec{\nabla}\cdot\vec{B}\, d\tau = \oint \vec{B}\cdot d\vec{a} = \phi$$

$$\left(B_\perp^{above} - B_\perp^{below}\right)\pi r^2 = 0$$

$$B_\perp^{above} = B_\perp^{below}$$

$$\boxed{\vec{\nabla}\times\vec{B} = \mu_0 \vec{J} \quad \text{Amps law}}$$

$$\int \underbrace{\vec{\nabla}\times\vec{B}}_{\mu_0\vec{J}}\cdot d\vec{a} = \oint \vec{B}\cdot d\vec{l}$$

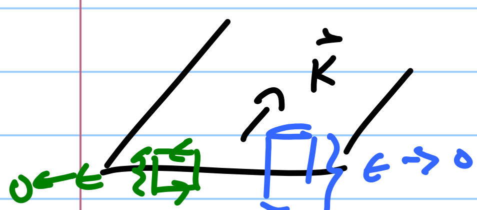
$$\underbrace{I_{enclose}}_{} = \oint \vec{B}\cdot d\vec{l}$$

$$\mu_0 K L = B_\parallel^{above} L - B_\parallel^{below} L$$

Bndry on $\vec{A}$

$$\vec{\nabla}\cdot\vec{A} = \phi \quad \text{Lorentz gauge}$$

$$\vec{\nabla}\times\vec{A} = \vec{B}$$

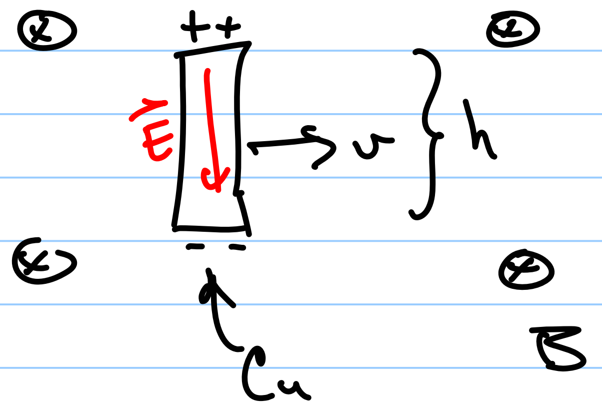


$$A_\perp^{above} = A_\perp^{below}$$

$$\Phi_m = \int \underbrace{\vec{\nabla}\times\vec{A}}_{B}\cdot \underbrace{d\vec{a}}_{\downarrow\, 0} = \oint \vec{A}\cdot d\vec{l} = 0$$

$$A_\parallel^{above} = A_\parallel^{below}$$

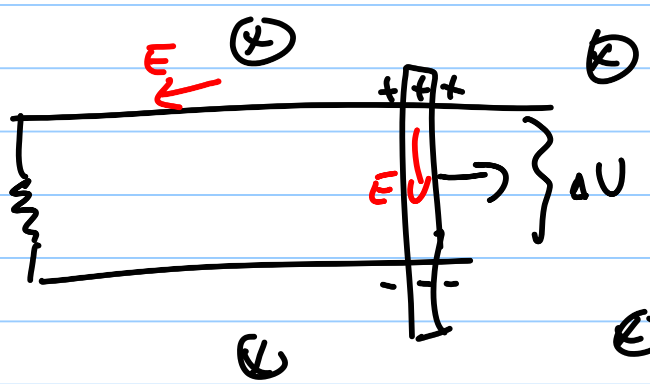
Faraday's law



$F = qE - qvB = 0$

$E = vB$

$\Delta V = -\int \vec{E}\cdot d\vec{l} = -Eh \rightarrow \underline{vBh} =$



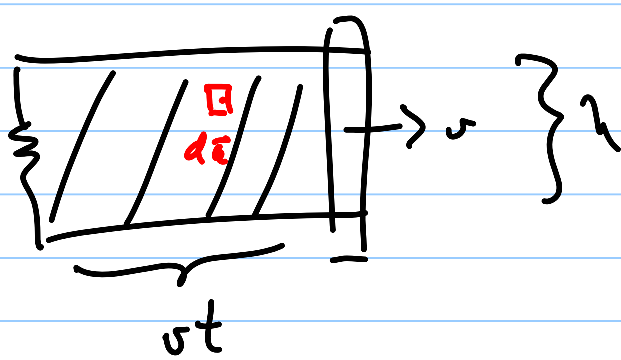
ΔV like a battery $\sim \text{Emf} = \underline{vBh}$

Faraday's law

$\text{Emf} = -\dfrac{d\Phi_B}{dt}$ ← magnetic flux

$\Phi_B = \int \vec{B}\cdot d\vec{a}$

$= \int B_0\, da \underbrace{\cos\varphi}_{1}$



$\Phi_B = B_0 h v t$

$|\text{Emf}| = \dfrac{d}{dt} B_0 h v t = B_0 h v$

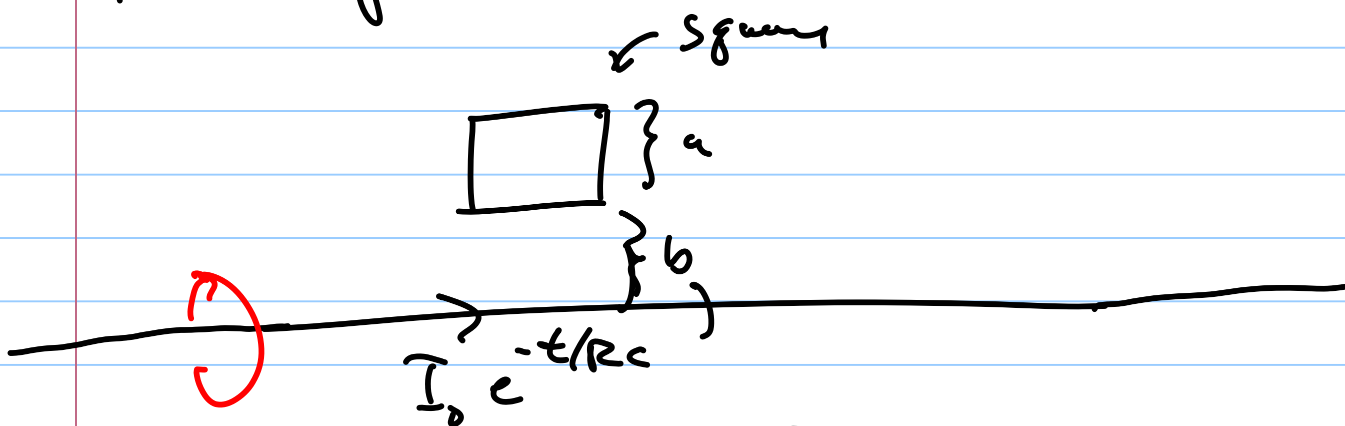
$\frac{d\Phi_B}{dt}$ can change $\left(\Phi = \int \vec{B} \cdot d\vec{a} \right)$

→ area changes with time area = L D(t)

→ B changes with time

→ angle between $\vec{B}$ & $d\vec{a}$ changes with time

Tablet question



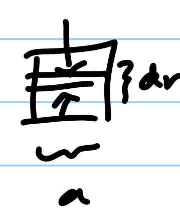
Principle: $\mathcal{E}mf = -\frac{d\Phi_m}{dt}$ $\Phi_m = \int \vec{B} \cdot d\vec{a}$

find B from Amp's law or Biot Savart

Method: find B (amps law path circle $\oint \vec{B} \cdot d\vec{l} = \mu_0 i$

$B = \frac{\mu_0 I_0 e^{-t/RC}}{2\pi r}$)

Cal $\Phi_m = \int \vec{B} \cdot d\vec{a}$ find $d\vec{a} = a\,dr$



$= \int_b^{b+a} \frac{\mu_0 I_0 e^{-t/RC}}{2\pi r} a\,dr$

Then take time derivative

Check $\quad b \to \infty \quad B \to 0$

$a \to 0 \quad$ no flux

$t \to 0 \quad e^{-t/RC} \to 0$

$$\frac{d}{dt} e^{-t/RC} = -\frac{1}{RC} e^{-t/RC}$$