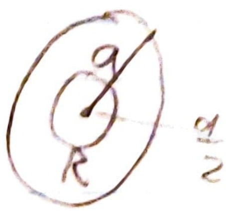
7.12 $\mathcal{E} = -\frac{d\Phi}{dt}$



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

$= \int_0^{2\pi}\int_0^{a/2} B_0 \cos(\omega t)\, s\, ds\, d\phi$ $\quad \vec{B}(t) = B_0 \cos(\omega t)\, \hat{z}$

$= 2\pi \frac{a^2}{4} B_0 \cos(\omega t) = \frac{\pi a^2}{2} B_0 \cos(\omega t)$

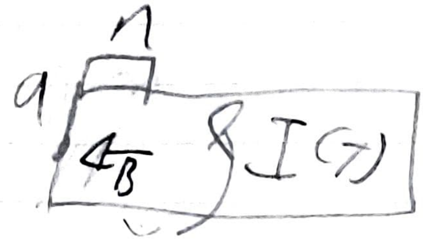
$\mathcal{E} = -\frac{\pi a^2}{2} B_0 (-\omega \sin(\omega t))$

$= \frac{\omega \pi a^2}{2} B_0 \sin(\omega t)$

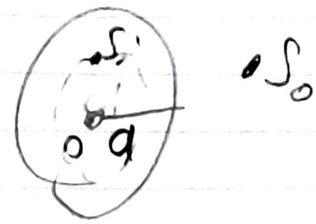
$\mathcal{E} = IR$

$$\boxed{I = \frac{\omega \pi a^2 B_0 \sin(\omega t)}{2R}}$$

7.15 Find $\vec{E}$ at a point in and out in quasistatic domain



$$\oint \vec{E}\cdot d\vec{l} = -\frac{d\Phi}{dt}$$



$$\Phi \equiv \int \vec{B}\cdot d\vec{a}$$

$\vec{B} = \mu_0 n I(t)$, inside

$$\int_0^{s}\int_0^{2\pi} \mu_0 n I(t) \cdot s\,ds\,d\phi = \pi s^2 \mu_0 n I(t) = \Phi$$

$$-\frac{d\Phi}{dt} = -I'(t)\pi s^2 \mu_0 n = 2\pi E(0) - 2\pi E(s)$$

$$\Rightarrow \boxed{-\frac{I'(t)s^2\mu_0 n}{2} = \vec{E}\,\hat{s}\text{, inside}}$$

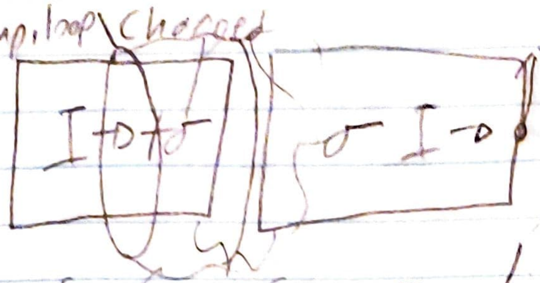
$\vec{B}_{out} = 0$ because solenoid

$$\int_0^{s}\int_0^{2\pi} 0 \cdot s\,ds\,d\phi = 0$$

$$\boxed{\vec{E}_{out} = 0\,\hat{s}}$$

7.34 A thick wire with radius a has current I. Find $\vec{B}$ in gap.

Amp loop charged



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

$\mu_0 \epsilon_0 \int \frac{\partial \vec{E}}{\partial t} \cdot d\vec{a}$

surface w<<a

$E = \frac{1}{\epsilon_0}\sigma = \frac{Q}{A}$

$\frac{\partial E}{\partial t} = \frac{1}{\epsilon_0 A}\frac{dQ}{dt}$

$= \frac{I}{\epsilon_0 A}$

I_{enc} $\int \frac{I}{\epsilon_0 A} \cdot da = \frac{I}{\epsilon_0}$

$\oint \vec{B} \cdot d\vec{l} = 2\pi s B$

$2\pi s B = \mu_0 I \left(\frac{s^2}{a^2}\right)$

$$\boxed{B = \frac{\mu_0 I s}{2\pi a^2}\hat{\phi}}$$