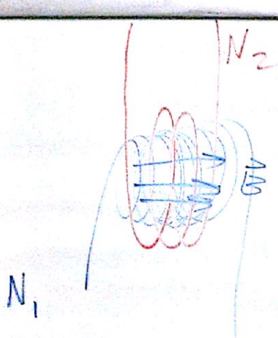
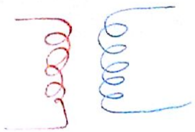


$$\frac{V_2}{V_1} = \frac{N_2}{N_1}$$

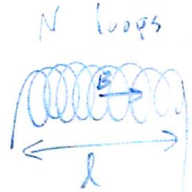
$$\frac{I_1}{I_2} = \frac{N_2}{N_1}$$

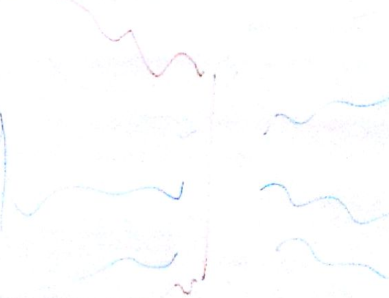


Changing I_1 creates changing $\vec{B}$ creates I_2

Inside solenoid

$$B = \frac{N \mu_0 I}{l}$$





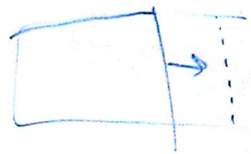
$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{encl}$$

$$\mathcal{E}_2 = -N_2 \frac{d\Phi_B}{dt}$$

$$= -N_2 \frac{dB}{dt} A \pi r^2$$

$$\Phi_B = \iint \vec{B} \cdot d\vec{A}$$

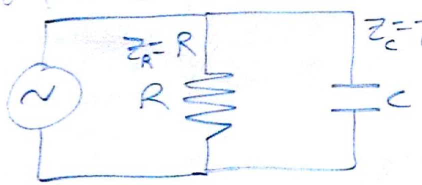
$$= BA\cos\theta$$



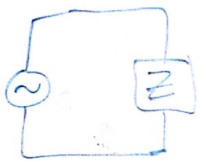
Ch. 27-31

Ch. 30 problem

$Z_R = R$ $\qquad Z_C = \frac{1}{i\omega C}$



$\approx$



$Z = ?$

$$\omega = \frac{2\pi}{T}$$

T = period of AC power source

$$\frac{1}{Z} = \frac{1}{Z_R} + \frac{1}{Z_C} = \frac{1}{R} + i\omega C \Rightarrow Z = \frac{\frac{1}{R} - i\omega C}{\sqrt{\left(\frac{1}{R}\right) + (\omega C)^2}} \Rightarrow \tan\phi = \frac{-\omega C/\sqrt{\ldots}}{1/R/\sqrt{\ldots}}$$

$$\left|\frac{1}{Z}\right| = \sqrt{\left(\frac{1}{R}\right)^2 + (\omega C)^2}$$

$$|Z| = \frac{1}{\sqrt{(1/R^2) + \omega^2 C^2}}$$

$$\tan\phi = -\omega R C$$

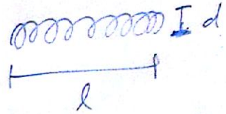
ϕ = phase by which current lags voltage

$5.0V - IR = V_{ab} = L \, dI/dt$

solenoid
$N = 100$ loops;
ℓ = length 5 cm
d = diameter 1 cm
empty inside

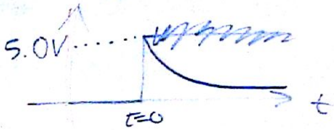
$$L = \frac{N\Phi_B}{I} = \frac{NBA}{I} = \frac{NB\pi(d/2)^2}{I} = \frac{\mu_0 N^2 \pi d^2/4}{\ell}$$

$$B = \frac{\mu_0 N I}{\ell} \quad \text{(solenoid)}$$



$\mu_0 = 4\pi \times 10^{-7} \frac{N}{A^2}$

$V_{ab} = 5.0V$



$$V = L\frac{dI}{dt} = L(2.5A)\tau e^{-t/\tau} = (2.5A)R e^{-t/\tau} = (5.0V)e^{-t/\tau}$$

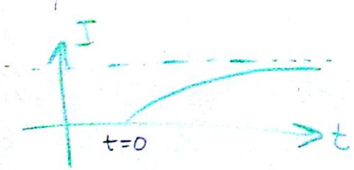
$\mu > \mu_0$

iron vacuum ≈ air

$\lim_{t \to \infty} I = ? \quad \frac{5.0V}{2\Omega} = 2.5A$

energy $= U = \frac{1}{2}LI^2 = \int_0^V I\,dV = \int_0^I I L\,dI$

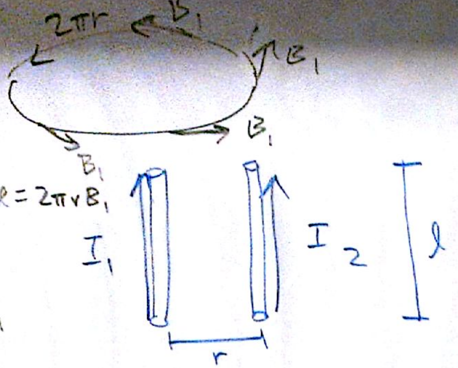
u = energy density $= \frac{B^2}{2\mu_0}$



$\tau = \frac{L}{R}$ = time for V_{ab} to decrease by factor of e

$$I = 2.5A\left(1 - e^{-t/\tau}\right)$$

Generated by CamScanner from intsig.com



$\oint \vec{B}_1 \cdot d\vec{l} = 2\pi r B_1$

$\parallel$

$\mu_0 I_1$

$B_1 = \frac{\mu_0 I_1}{2\pi r}$

$F_2 = I_2 l B_1$

$F = \frac{\mu_0 I_1 I_2 l}{2\pi r}$

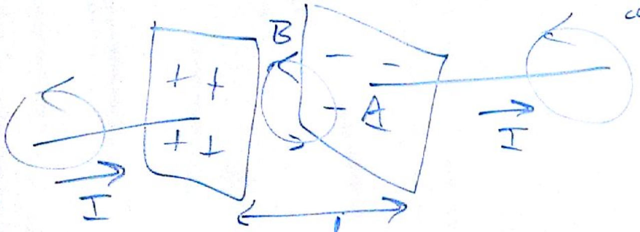
$\vec{F} = q\vec{E} + q\vec{v} \times \vec{B}$

$1T = \frac{1N}{1C\ m/s} = \frac{1N}{1A \cdot m} = \frac{1V}{1\ m/s} = \cdots$

$$\oint \vec{B} \cdot d\vec{l} = \mu_0 I_{encl} + \mu_0 \boxed{\epsilon_0 \frac{d\Phi_E}{dt}}$$

called displacement current

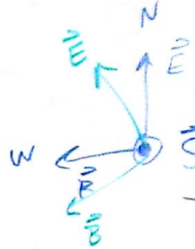
current can create changing $\vec{E}$, which creates $\vec{B}$



$$\frac{dE}{dt} = \frac{1}{l}\frac{dV}{dt} = \frac{1}{lC}\frac{dQ}{dt} = \frac{I}{lC}$$

$$\frac{d\Phi_E}{dt} = A\frac{dE}{dt} = \frac{AI}{lC}$$

$E = \frac{V}{l}$ $\quad V = \frac{Q}{C}$ $\quad I = \frac{dQ}{dt}$



$$\vec{S} = \frac{1}{\mu_0}\vec{E} \times \vec{B}$$ "up"

power per area

= energy per area per time

EM Wave

$E = cB$

$c = \frac{1}{\sqrt{\epsilon_0 \mu_0}}$

$u = \epsilon_0 E^2 = \mu_0 B^2 = \epsilon_0 c E B$

$u = \frac{1}{2}\epsilon_0 E^2 + \frac{1}{2}\mu_0 B^2$