Physics 201 Day 20

No AC Circuits on Exam 2

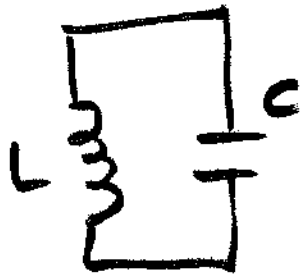
$X_L = \omega L \quad X_C = \frac{1}{\omega C} \quad Z = \sqrt{R^2 + (X_L - X_C)^2}$

$V = ZI$

RC or LR or LC Circuits

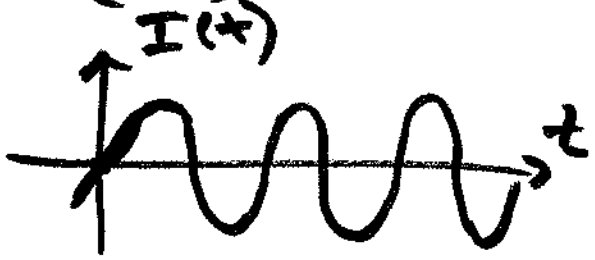
Graph or write words or equation for $I(t)$ after some "event" at $t=0$

LC at $t=0$ quickly charge C



$I(t) = I_0 \sin(\omega t)$

$\omega = \frac{1}{\sqrt{LC}}$



$\tau = RC$

$\tau = \frac{L}{R}$

Inductor, L,

$\vec{I}$ when I changes,

$V = -L \frac{dI(t)}{dt}$

$$\sum_{\text{loop}} V = 0 = -L\frac{dI(t)}{dt} - \frac{Q(t)}{C} = 0$$

$Q = CV$ $\qquad I = \frac{dQ}{dt}$

$$-L\frac{d^2Q(t)}{dt^2} = \frac{Q(t)}{C}$$

Try: $Q(t) = Q_0 \sin(\omega t + \phi)$

↑ phase

$\frac{d^2Q}{dt^2} = -Q_0 \sin(\omega t)\,\omega^2$ $\qquad$ set $\underline{\phi = 0}$

$$+L Q_0 \sin(\omega t)\,\omega^2 \stackrel{?}{=} \frac{Q_0}{C}\sin(\omega t)$$

$$\boxed{\omega = \frac{1}{\sqrt{LC}}}$$

Sample Exam Solution:

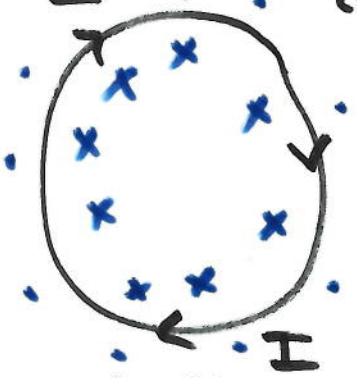
#6 A. $\vec{C} = \vec{A} \times \vec{B}$ if $\vec{A}$ and $\vec{B}$ in plane
What can $\vec{C}$ be?

Answer: $\vec{C}$ points $\perp$ to page (out of or into page) or $\vec{C} = 0$

what if $\vec{A} \parallel \vec{B}$? Then $\vec{C} = 0$.

$0 \leq |\vec{C}| = C \leq |\vec{A}| \cdot |\vec{B}|$

#6B. I loop in plane.



#6C. $\vec{B}$ from above page downward.

Lenz's Law find direction of I.

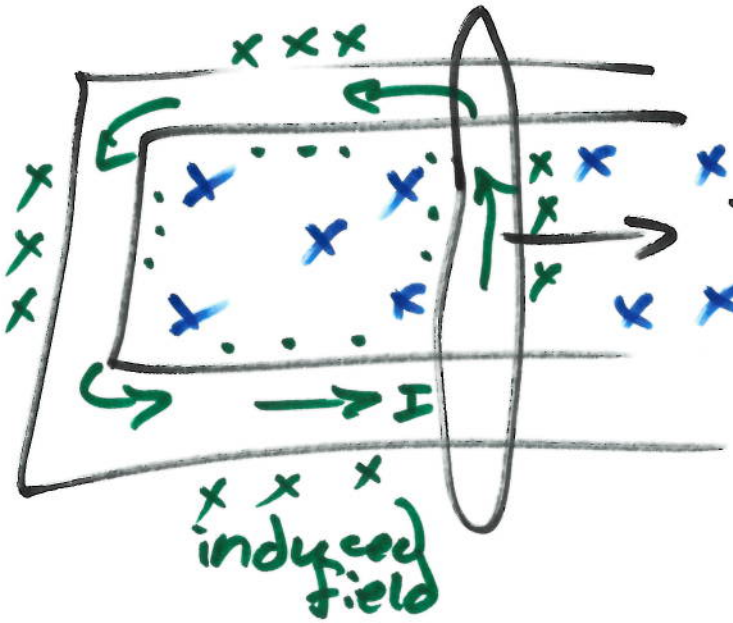
blue field "induced" B to counter external flux change.

so blue current is counter clock wise.

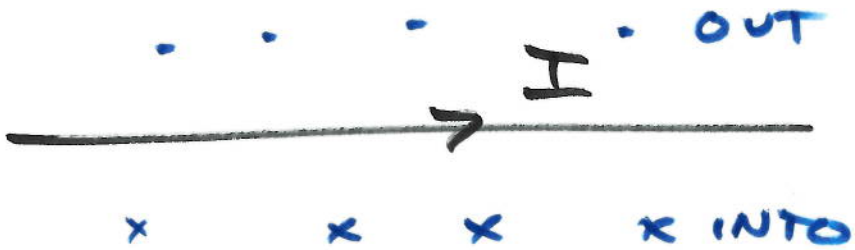
$\Phi_B = \int \vec{B} \cdot d\vec{a}$

is magnetic flux, ~~of~~

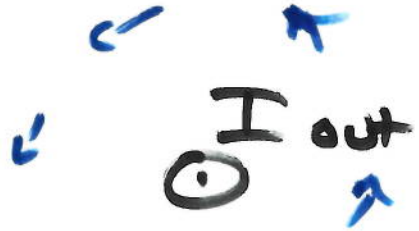
Ex: Lenz:



6.D. Given I, sketch $\vec{B}$ direction.



6.D. Alt.



$\vec{B}$ circles

magnetic materials:

3 of them: Ferro- (↑ magnet) Para- Dia-

a. If your unknown material is repelled by N-pole of a ferromagnet, what could it be?

Ferro (N-pole) or diamagnet.

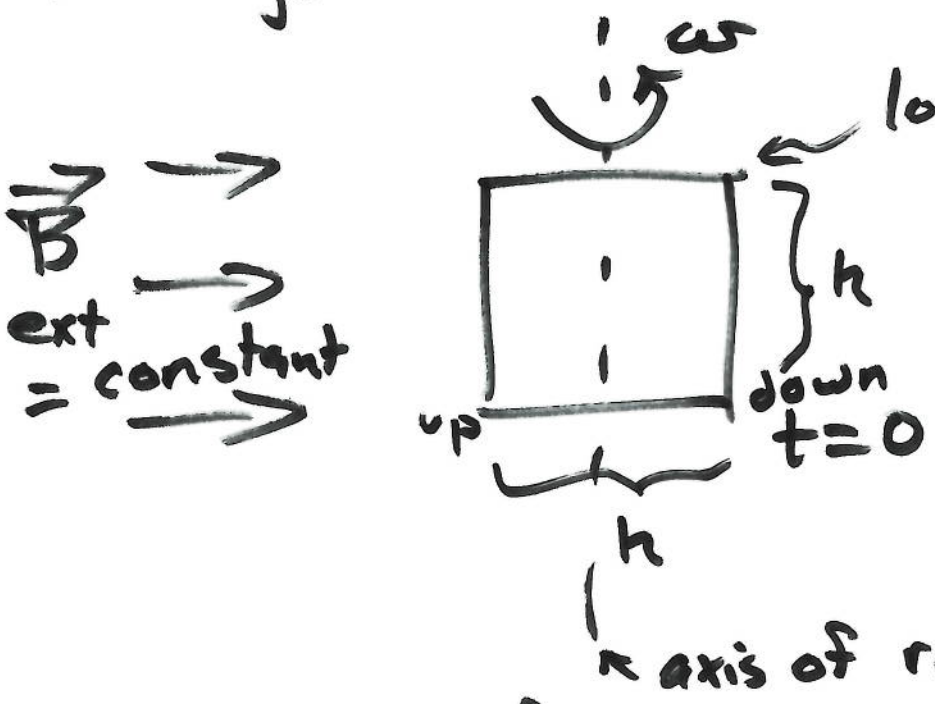
b. If in a, you got multiple possible answers, how could you tell them apart?

Flip known ferromagnet around and approach the S-pole with the same side of unknown.

Now, if repels, unknown = diamagnet

and if attracts, unknown = ferro

Faraday's Law with θ changing:



$$\theta = \omega \cdot t$$

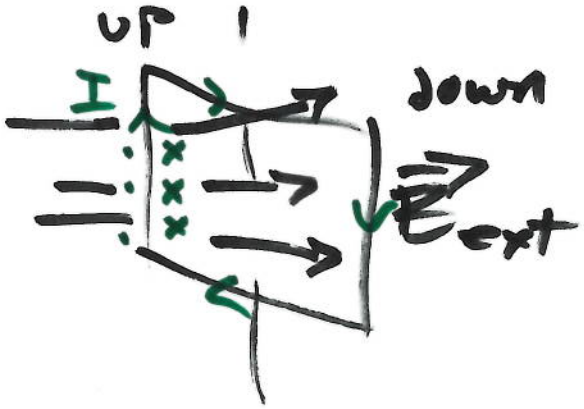
$$V = \frac{d}{dt}\Phi$$

Find: $V = \frac{d}{dt}\int \vec{B}\cdot d\vec{a}$ or ~~sin~~ cos (ωt)...

$$= \frac{d}{dt} B h^2 \ \text{~~cos~~ sin}(\omega t)$$

let's choose sin to show $\Phi = 0$ at $t = 0$.

$$\boxed{V = Bh^2 \cos(\omega t)\omega}$$



change OH tomorrow only will be in from 1-2pm. (not 2-3pm)

I will email thus.