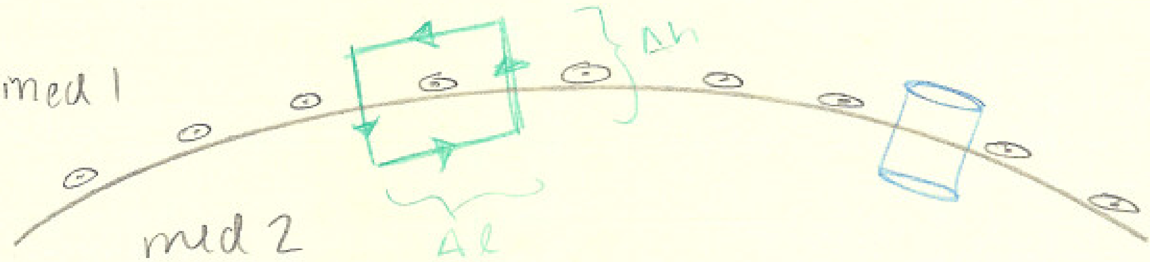
$\mu = \mu_r \mu_o$

(μ_r:) 1 unless otherwise stated.



$$\oint \vec{B} \cdot d\vec{s} = 0$$

side → 0

∴ no flux escapes from the sides.

$$= \int_{top} \vec{B} \cdot d\vec{s} + \int_{bottom} \vec{B} \cdot d\vec{s} = 0$$

$$= B_{1n} \cdot Area - B_{2n}\, Area = 0$$

$$\therefore\ B_{1n} = B_{2n}$$

$$\oint_c \vec{H} \cdot d\vec{l} = I_{enclosed}$$

$\Delta h \to 0$

$$= \oint_{med\,1} \vec{H} \cdot d\vec{l} + \oint_{med\,2} \vec{H} \cdot d\vec{l}$$

$$= H_{2t} \cdot \Delta l - H_{1t} \cdot \Delta l = K \cdot \Delta l$$

$$\therefore \quad H_{2t} - H_{1t} = K$$

for most practical applications in this course $K = 0$.

K: surface current density.

End of Static Problems.

$$\Phi_m = \int \vec{B} \cdot d\vec{S} \qquad \boxed{0 = \oint \vec{B} \cdot d\vec{S}}$$

Φ_m: Magnetic flux

$\int \vec{B} \cdot d\vec{S}$: Open Surface

$\oint$: Closed Surface (no magnetic monopoles)

if $\dfrac{d\Phi_m}{dt} \neq 0$; then one can create current.

Conveinient

The convienient voltage for the source of this current is called EMF

$$V_{EMF} = -\frac{d}{dt}\left(\int \vec{B} \cdot d\vec{S}\right)$$

* Surface is stationary, B changes w time

$$V_{EMF}^{tr}$$

tr: transformer

* $\vec{B}$ constant, but S is changing

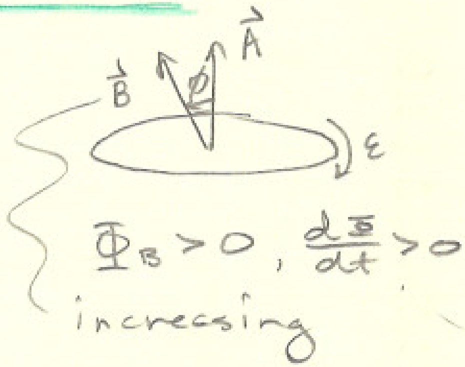
V_{EMF}^{m} m: motional

* Both change in time.

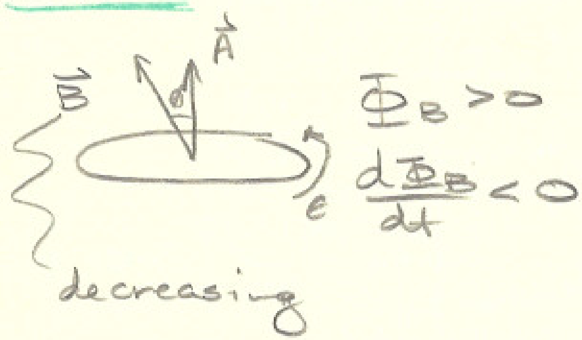
Lenz's Law

(how to determine the direction of the induced current)

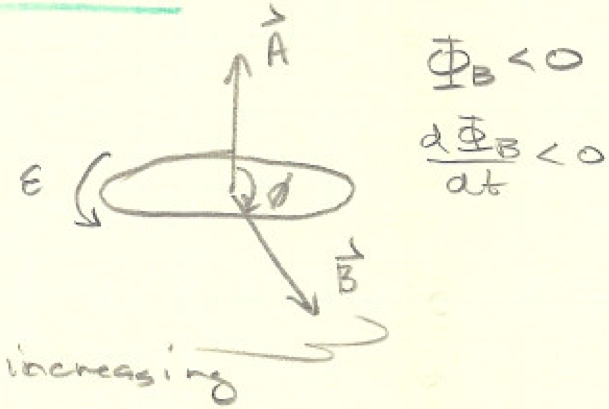
Case A



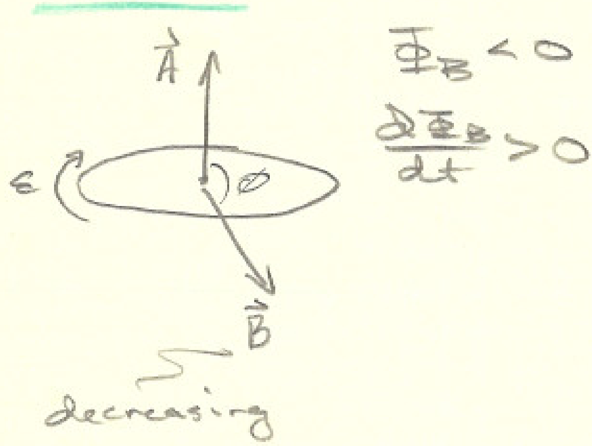
Case B



Case C



Case D



Case A

$$|\vec{B}(t+\Delta t)| > |\vec{B}(t)|$$

$$d\vec{s} = (\text{up})$$

$$\vec{B} \cdot d\vec{s} > 0$$

$$\Phi_m(t+\Delta t) = |\vec{B}(t+\Delta t)|(\text{Area})\cos\phi$$
$$\Phi_m(t) = |\vec{B}(t)|(\text{Area})\cos\phi$$

$$\frac{d\Phi_m}{dt} = \varepsilon\left(\frac{\Phi_m(t+\Delta t) - \Phi_m(t)}{\Delta t}\right) > 0$$

"ε" must be negative; this reverses the current in the loop; hence make $d\vec{s}$ negative