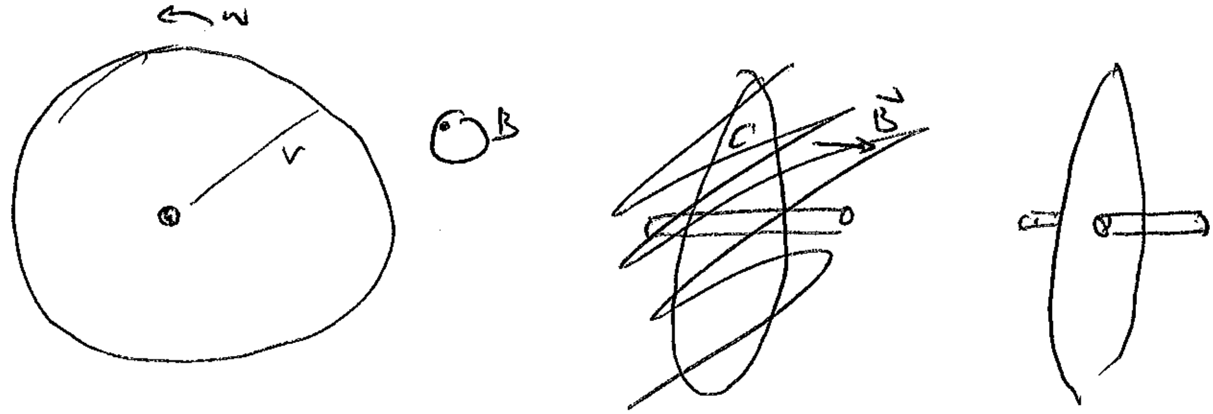
AFTER DOING THE RADIAL MOTION EMF



$$\mathcal{E} = \frac{1}{2} R^2 B \omega$$

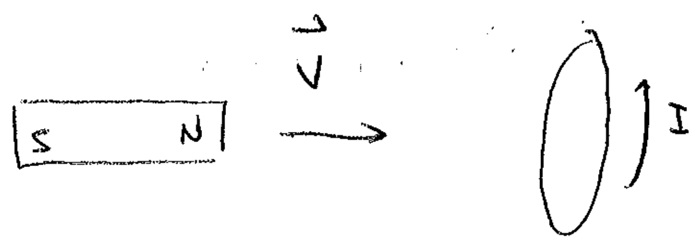
HOMOPOLAR GENERATOR

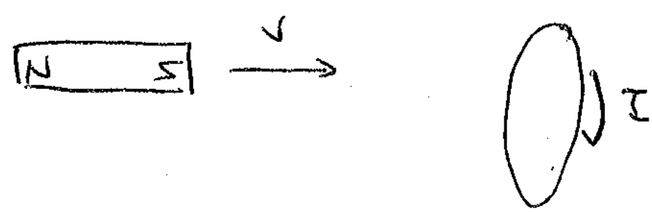
SOURCES OF EXTREMELY HIGH CURRENT

LECTURE 4/1

LENZ'S LAW

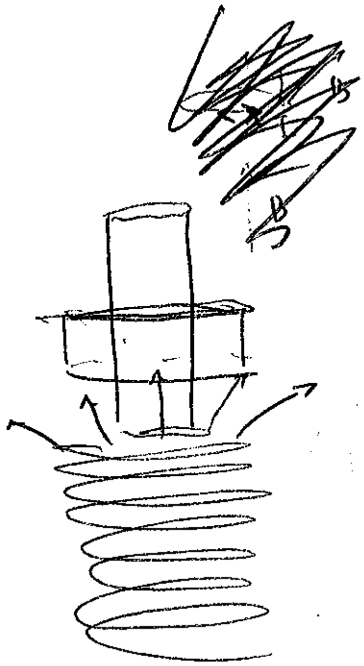
INDUCED CURRENT ALWAYS OPPOSES MAGNETIC FIELD CHANGE





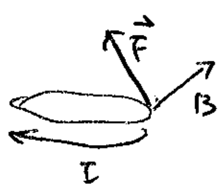
FOR EXAMPLE.

DRAMATIC EXPERIMENT EM 423



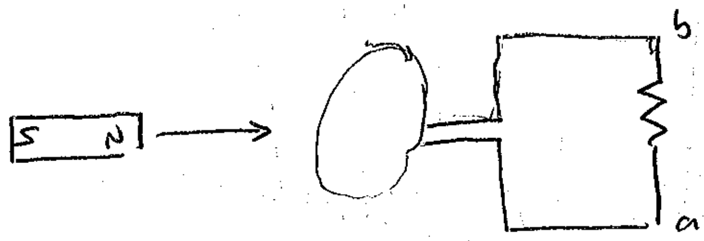
$\frac{dB}{dt}$

$\vec{B}$ INCREASING



FLIES OFF

EXAMPLE



$V_a - V_b$ NEGATIVE OR POSITIVE?

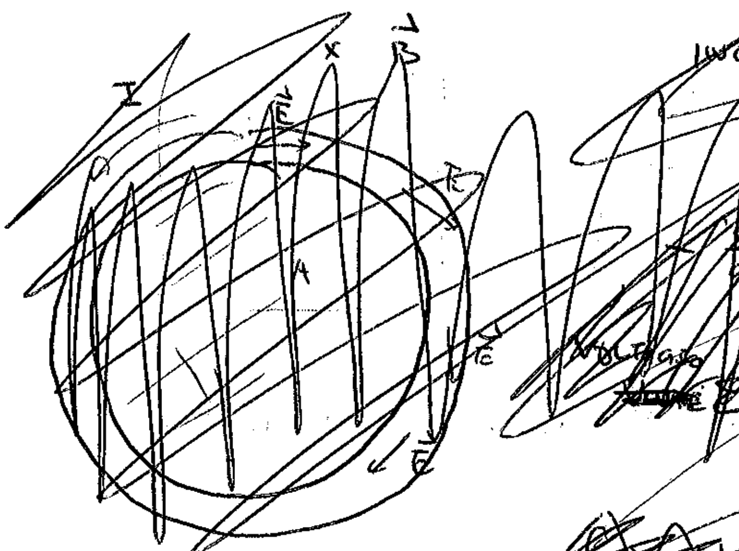
NEGATIVE

ANOTHER EXAMPLE:

MAGNET DROPPING EXPT

EM 415

~~INDUCED EMF~~



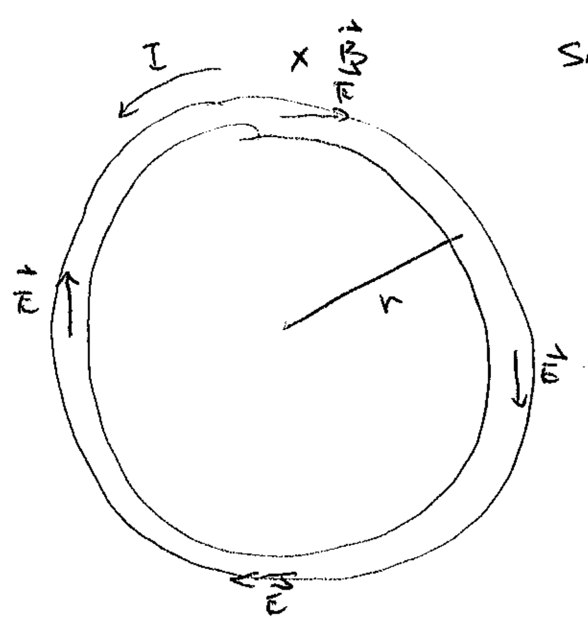
$$\cancel{\frac{d}{dt}(BA) = \mathcal{E}}$$

~~VOLTAGE~~ $\cancel{\mathcal{E} = E(2\pi r)}$

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

HOW DOES IT RELATE TO ELECTRIC FIELDS?

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



SAY IT IS INCREASING.

IT HAS TO BE UNIFORM

$2\pi r\, E = \mathcal{E}$ (VOLTAGE)

$$E = \frac{\mathcal{E}}{2\pi r}$$

$$E = -\frac{1}{2\pi r}\frac{d\Phi_B}{dt}$$

$$= -\frac{1}{2\cancel{\pi}\cancel{r}}\cancel{\pi} r^2 \frac{dB}{dt}$$

$$\vec{E} = -\frac{r}{2}\frac{d\vec{B}}{dt}$$

$$2\pi r E = \mathcal{E} = -\frac{d\Phi_B}{dt}$$

$$\boxed{\oint \vec{E}\cdot d\vec{s} = -\frac{d\Phi_B}{dt}}$$

GENERAL FORM

CHANGING MAGNETIC FIELD GENERATES ELECTRIC FIELD

$$\oint \vec{E}\cdot d\vec{A} = \frac{Q_{enclo.}}{\varepsilon_0}$$

DIVERGENCE THEOREM

$$\oint \vec{E}\cdot d\vec{A} = \int \vec{\nabla}\cdot\vec{E}\, dV = \frac{1}{\varepsilon_0}\int \rho\, dV$$

$$\boxed{\vec{\nabla}\cdot\vec{E} = \frac{\rho}{\varepsilon_0}}$$ GAUSS'S LAW

$$\oint B\cdot d\vec{A} = 0 \qquad \boxed{\vec{\nabla}\cdot\vec{B} = 0}$$

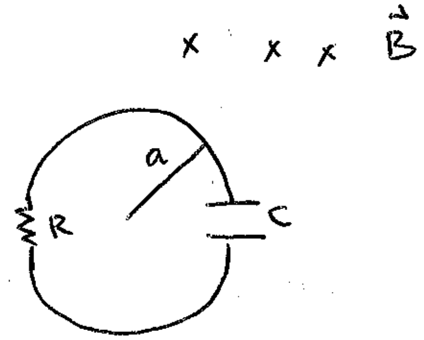
$$\oint \vec{E}\cdot d\vec{s} = \int(\vec{\nabla}\times\vec{E})\cdot dA = -\int\frac{dB}{dt}\,dA$$

$$\boxed{\vec{\nabla}\times\vec{E} = -\frac{d\vec{B}}{dt}}$$

$$\oint B \cdot ds = \mu_0 I$$

$$\rightarrow \quad \vec{\nabla} \times \vec{B} = \mu_0 J + \underline{?}$$

$\mu_0 \varepsilon_0 \frac{\partial E}{\partial t}$ LATER



$$\frac{d\vec{B}}{dt} = -|K|$$

$$\mathcal{E} = -\frac{d\Phi_B}{dt} = K \pi a^2$$