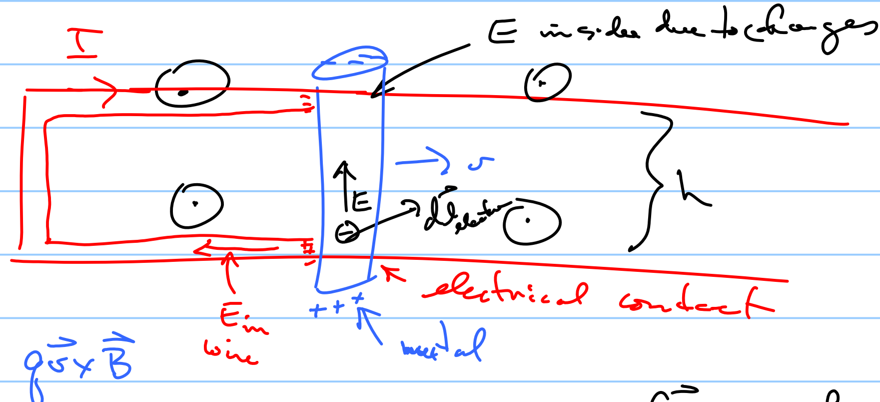
Lecture 31 April 10

Note Title 4/10/2006

Don't hand in this week ch 7 prob. 20 & 26

review: What current density produces const. azimuthal vector potential.

$$\nabla^2 \vec{A} = \mu_0 \vec{J}$$



Work done on charge in moving wire $\int \vec{F}\cdot\vec{dl} = \int q\vec{v}\times\vec{B}\cdot\vec{dl}$ (up the wire)

$= q v B h = q E_{battery} = q\, \mathcal{E}mf$

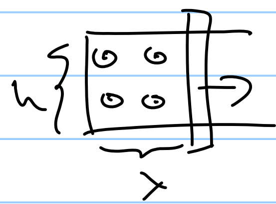
(before $W_B = 0 = \int q\vec{v}\times\vec{B}\cdot d\vec{l}_{\text{electron}}$, with $d\vec{l}_{\text{electron}} = \vec{v}\,dt$, not the $d\vec{l}$)

Encompassed in Faraday's Law

$$\mathcal{E}mf = -\frac{d\Phi_B}{dt} \qquad \Phi_B = \int \vec{B}\cdot d\vec{a}$$

↑ Lenz law

Ex:



$$\Phi_B = \int B_0\, da \cos\theta = Bxh$$

$$\frac{d\Phi_B}{dt} = Bhv$$

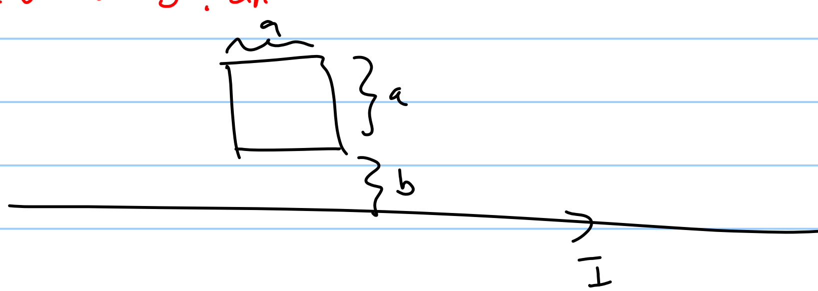
Get Emf due

(1) area can change with time

(2) B " " "

(3) angle between B & $d\vec{A}$ " "

Problem

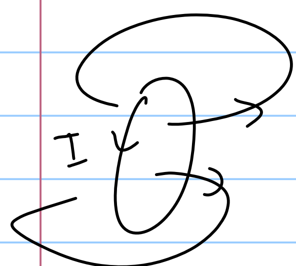


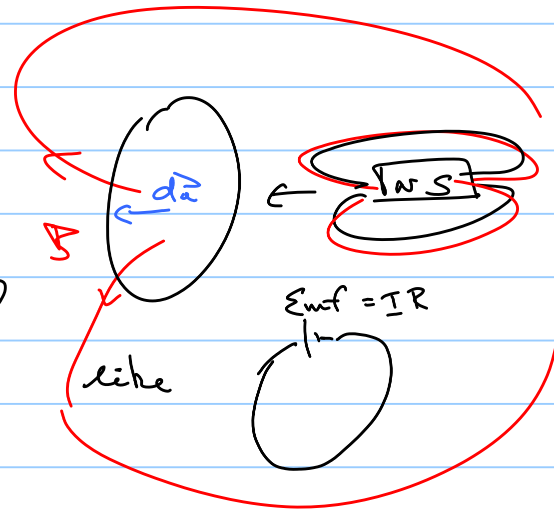
$d\vec{F} = I\, d\vec{l} \times \vec{B}$ electric motor

Faraday's electric generators

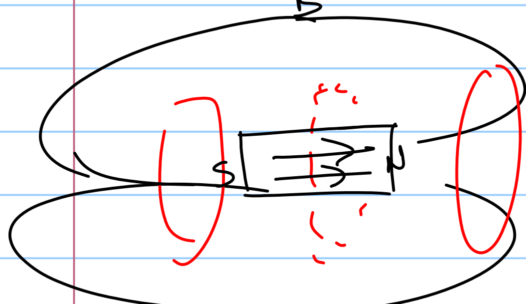
$\mathcal{E}mf = -\frac{d\Phi_B}{dt}$

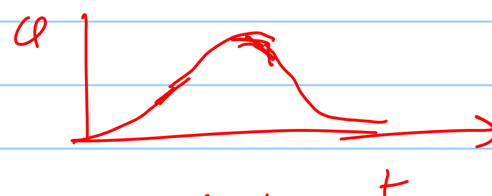
↑ direction current flow opposes increasing $\vec{B}$





find Φ_B as bar magnet goes thru loop





B is always in same direction

Emf $\propto \frac{d\Phi}{dt}$

$= IR$