Faraday's Law

Changing B.

Changing A.

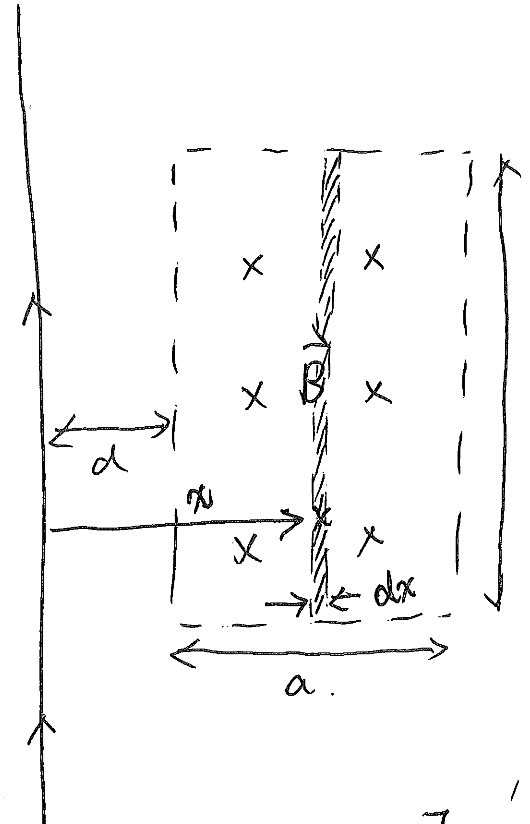
Will Cause E (New). $\leftarrow \mathcal{E} = -\frac{d}{dt}\Phi_B \rightarrow$ $\vec{F} = q\vec{v}\times\vec{B}$

or $I\vec{L}\times B$

(Only if you have charges).

Maxwell's 4th Eq.

Define $\odot$ is $+$.



$I = I_0 e^{-\frac{t}{\tau}}$.

$$B = \frac{\mu_0 I}{2\pi x} \otimes$$

B Flux of the infinitesimal Element

$$= -\frac{\mu_0 I}{2\pi x} \cdot b\,dx$$

$$\Phi = -\int_d^{d+a} \frac{\mu_0 I}{2\pi x} b\,dx.$$

$$= -\frac{\mu_0 I b}{2\pi}\left[\ln x\right]_a^{d+a} = -\frac{\mu_0 I b}{2\pi} \ln \frac{d+a}{a}$$

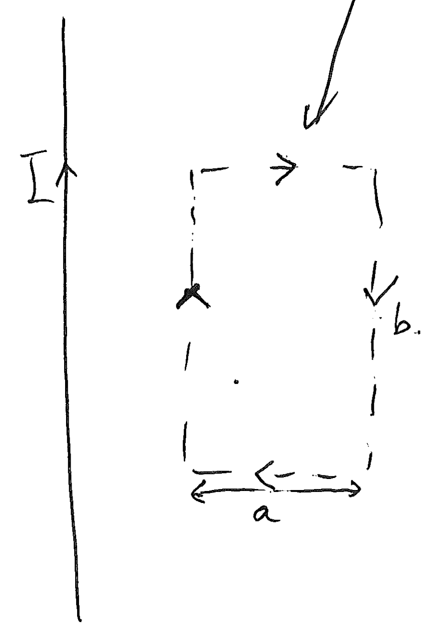
$$I = I_0 e^{-t/\tau} \qquad (I_0, \tau \text{ are constant}).$$

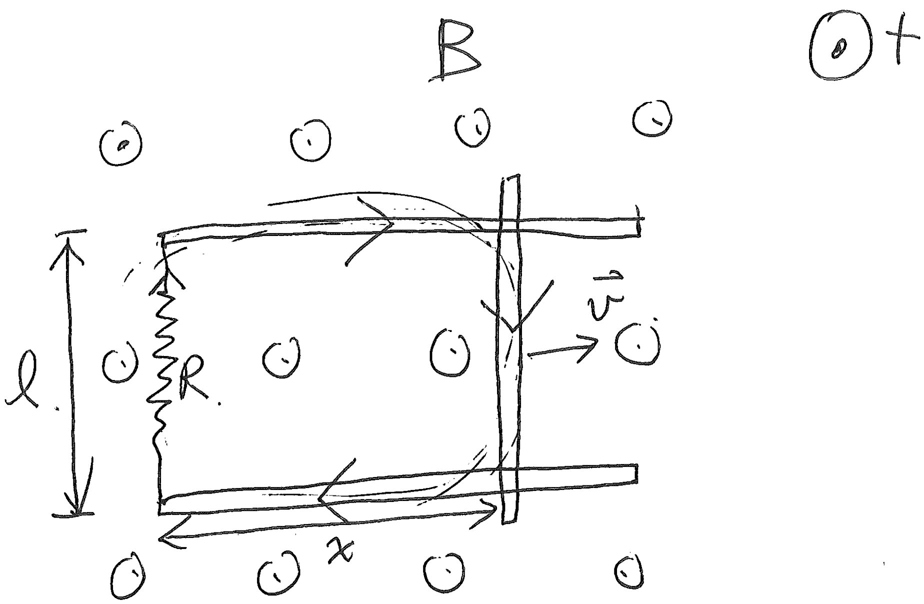
$$\Phi = -\left(\frac{\mu_0 b}{2\pi} \ln \frac{d+a}{a}\right) I_0 e^{-\frac{t}{\tau}}.$$

Emf: $\oint \vec{E} \cdot d\vec{s} = -\frac{d\Phi}{dt}$

$$= -\frac{d}{dt}\left[-\left(\frac{\mu_0 b}{2\pi} \ln \frac{d+a}{a}\right) I_0 e^{-\frac{t}{\tau}}\right]$$

$$= -\frac{\mu_0 b}{2\pi\tau}\left(\ln \frac{d+a}{a}\right) I_0 e^{-\frac{t}{\tau}}.$$





$$\text{Flux } \Phi = BA = +Blx$$

$$\mathcal{E} = -\frac{d\Phi}{dt} = -Bl\frac{dx}{dt}$$

$$= -Blv$$

Faradays Law.

Ohm's Law

$$I = \frac{\mathcal{E}}{R} = -\frac{Blv}{R}$$