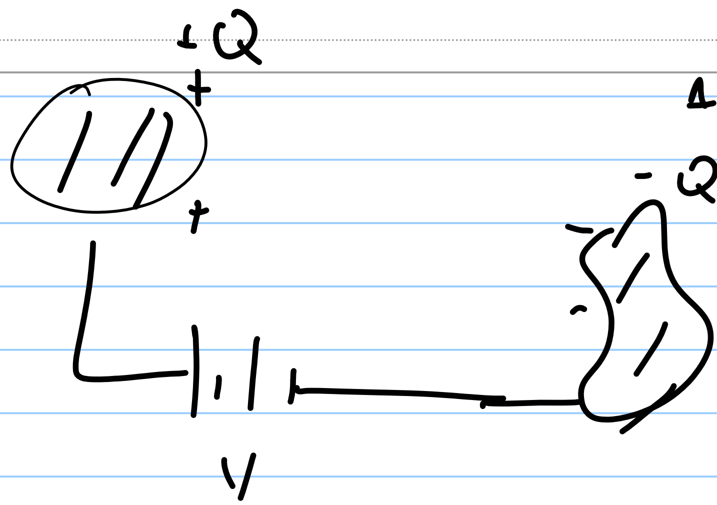
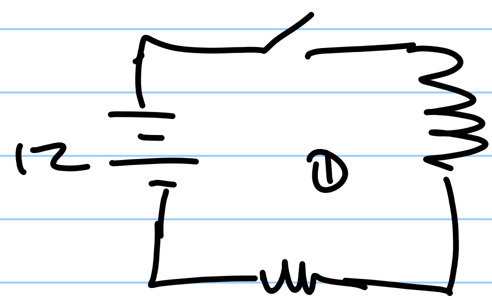
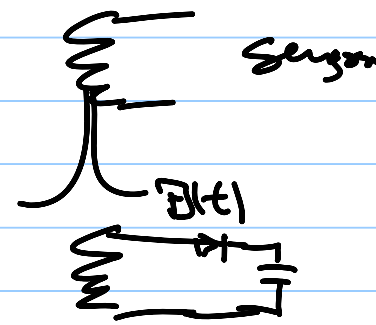


$\Delta V \propto Q$

$\Delta V = \frac{1}{C} Q$

geometry





Blaster card

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

flux thru one loop

flux in circuit 2

$$\Phi_{12} \propto i_1 \qquad N_2 \Phi_{12} \equiv M_{12}\, i_1$$

due to circuit 1

mutual inductance

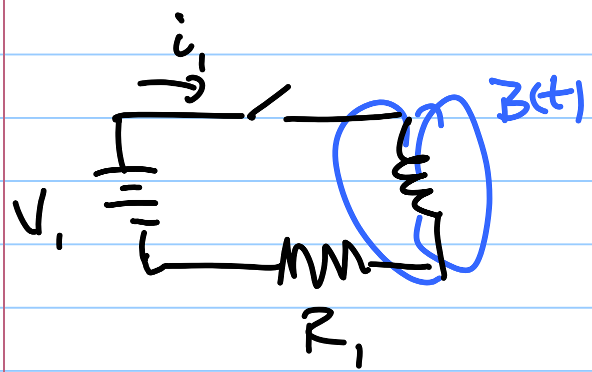
$$\mathcal{E}mf_{12} = -\frac{d\Phi_m}{dt} = -\frac{d}{dt} M_{12}\, i_1 = -M_{12}\frac{di_1}{dt}$$

depends on geometry (const)

Circuit 2 Kirch:

$$V_2 - i_2 R_2 \pm M_{12}\frac{di_1}{dt} \underbrace{}^{-L_2\frac{di_2}{dt}} = 0$$

? missing ? self induction



$$\text{emf} = -\frac{d\Phi_m}{dt} = -\frac{d}{dt}Li = -L\frac{di}{dt}$$

$$\Phi_m \propto i_1 \quad N_1\Phi_m = Li_1$$

self induction

Power:

$$\underbrace{V_1 i_1}_{\text{Power delivered by batt}} - i_1^2 R_1 - \underbrace{L_1\frac{di_1}{dt}}_{V}\,\underbrace{i_1}_{i_1} = \text{power delivered to inductor}$$

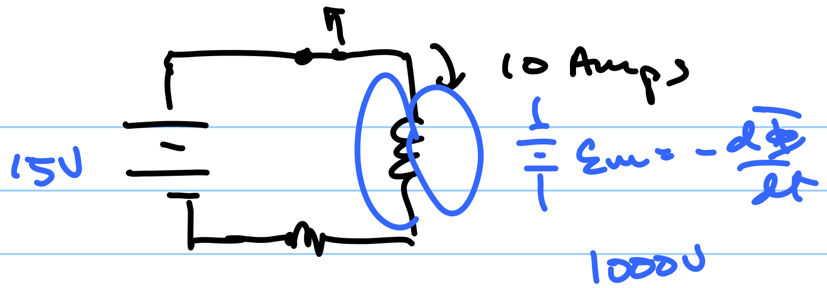
$$\left[\frac{dW}{dt} = L_1 i_1 \frac{di_1}{dt}\right] \times dt = \int dW = \int L_1 i_1\, di_1$$

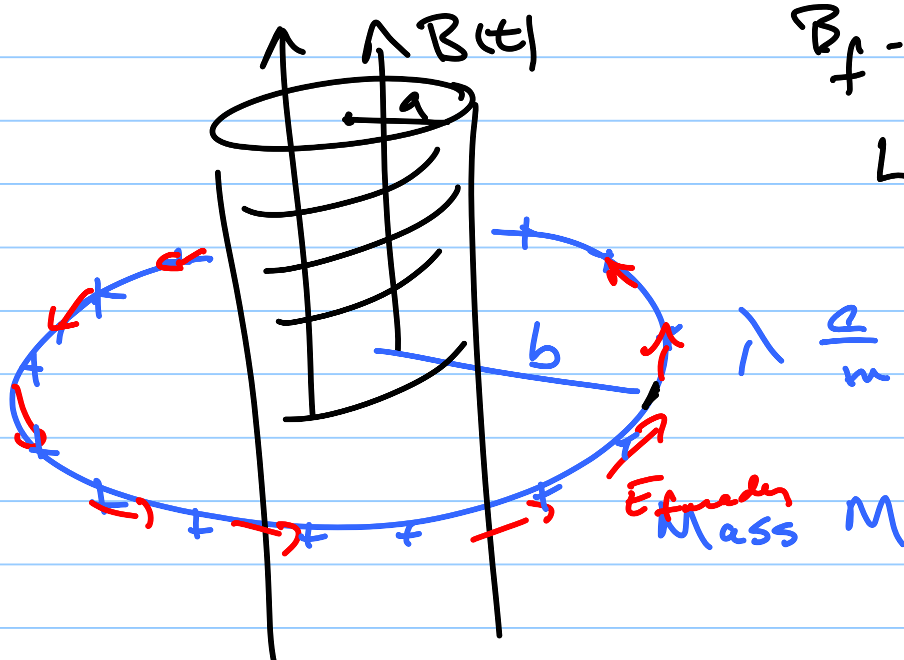
$$\text{Energy in inductor} = L_1 \frac{i_1^2}{2}\Big|_0^{i_f} = \frac{1}{2}L_1 i_f^2$$

Energy stored in B

$$u\left(\frac{J}{m^3}\right) = \frac{1}{2}\frac{B^2}{\mu_0}$$

$$u\left(\frac{J}{m^3}\right) = \frac{1}{2}\epsilon_0 E^2$$





$B_f - B_i = \Delta B$

$L_i = 0$

$\Delta L = ?$

$\boxed{\text{Principle}}$: $\mathcal{E}mf = -\frac{d\Phi_m}{dt}$ $\Rightarrow$ electric field which generates a force.

$d\,\text{Force} = E_{faraday}\,\underbrace{\lambda\, dl}_{dq}$

torque $\left(d\vec{\tau} = \int \vec{r} \times d\vec{F} = \frac{d\vec{L}}{dt}\right.$

$|\vec{B}||d\vec{a}|\cos\phi$

← constant around circle

$\boxed{\text{Method}}$: find $\Phi_m = \int \vec{B} \cdot d\vec{a} = B\pi a^2$

$$\underbrace{\mathcal{E}mf = \oint \vec{E} \cdot d\vec{l}}_{E\,2\pi b} = \pi a^2 \frac{dB}{dt}$$

$$E\, 2\pi b = \pi a^2 \frac{dB}{dt}$$

$$E = \frac{\pi a^2}{2\pi b}\frac{dB}{dt}$$

$$dF = dq\,E = \lambda\, d\ell\, E$$

$$|\vec{\tau}| = |\vec{r} \times \vec{F}| \Rightarrow \int \overset{r}{b}\,\underbrace{\lambda\, d\ell\, E}_{dF} = \int d\tau$$

$$\tau = \int_0^{2\pi b} \overset{r}{b}\,\underbrace{\lambda\, d\ell}_{dq}\,\overbrace{\frac{\pi a^2}{2\pi b}\frac{dB}{dt}}^{E} = \frac{dL}{dt}$$

$$b\lambda \frac{\pi a^2}{2\pi b}\frac{dB}{\cancel{dt}}\,2\pi b = \frac{dL}{\cancel{dt}}$$

$$\int_{B_i}^{B_f} \cancel{b}\lambda \frac{\cancel{\pi} a^2}{\cancel{2}\cancel{\pi}\cancel{b}}\,dB\,\cancel{2}\pi b = \int_{\phi}^{L_f} dL$$

$$\lambda a^2 \pi b\,(B_f - B_i) = L_f - \phi$$