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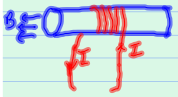
Self-Inductance

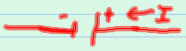


Lenz's Law

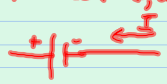
$\mathcal{E} = -L\frac{\Delta I}{\Delta t}$ — Volt; Amps; s

L: inductance, henry (H)

If I increases, emf(-) opposes increase



If I decreases, emf(+) opposes decrease



RL Circuit

resistance - opposition to current

inductance - " " change

$N = nl$

N - turns

l - length in m

n - $\frac{\text{turns } N}{\text{length } l}$

$1\,H = 1\,\frac{V \cdot s}{A}$

$\mathcal{E} = N\frac{\Delta\Phi}{\Delta t} = L\frac{\Delta I}{\Delta t}$

and

$L = N\frac{\Delta\Phi}{\Delta I} = N\frac{\Phi}{I}$

20.7 L=? N, l proof see notes

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L=?

$N = 300$

$l = 25\,cm$

$A = 4\,cm^2 = 4\times10^{-4}\,m^2$

$4\pi\times10^{-7}\,\frac{T\cdot m}{A}$

$B = \mu_0 n I$

$L = N\frac{\Phi}{I} = \frac{NBA}{I}$

$L = \frac{N(\mu_0 n I)A}{I}$

$L = N\mu_0\frac{N}{l}\cdot A$

$L = \frac{N^2\mu_0 A}{l}$

$= \frac{300^2(4\pi\times10^{-7})4\times10^{-4}\,m^2}{.25}$

$L = .000181\,H$

find $\mathcal{E}$ = ?

$\frac{\Delta I}{\Delta t} = -50\,\frac{A}{s}$

$\mathcal{E} = -L\frac{\Delta I}{\Delta t} = -.000181(-50) = 9.05\,mV$

$\frac{\Delta I}{\Delta t}$ — time constant $\tau = \frac{L}{R}$

$PE_L = \frac{1}{2}LI^2$

$PE_C = \frac{1}{2}CV^2$