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Phys 122-401
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QUIZ 8: Inductance

Consider the following equations:

$\tau = \frac{L}{R}$ $\quad L = \frac{N\Phi_B}{I}$ (1) $\quad \Delta V = IR$ (2) $\quad \vec{F}_m = q\vec{v} \times \vec{B}$ (3)

$\vec{F}_e = q\vec{E}$ $\quad \vec{E} = -\frac{\Delta V}{\Delta x}$ (4) $\quad I \equiv \frac{\Delta Q}{\Delta t}$

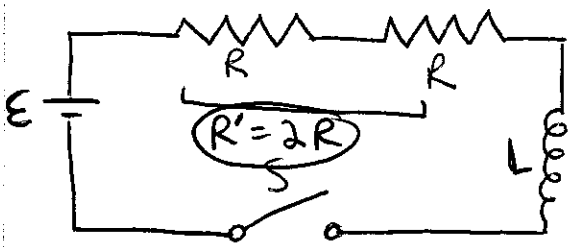
① Show that the time constant $\tau = \frac{L}{R}$ for an RL circuit has dimensions of time.

$$\tau = \frac{L}{R} = \left[\frac{\left(\frac{T \cdot m^2}{\cancel{s}}\right)}{\left(\frac{V}{\cancel{s}}\right)}\right] = \left[\frac{T \cdot m^2}{V}\right] = \left[\frac{\left(\frac{N}{\cancel{C}}\right)\cdot\left(\frac{\cancel{s}}{\cancel{m}}\right)\cancel{m}}{\left(\frac{N}{\cancel{C}}\right)\cancel{m}}\right]$$

by (1), (2) $\qquad$ by (3), (4)

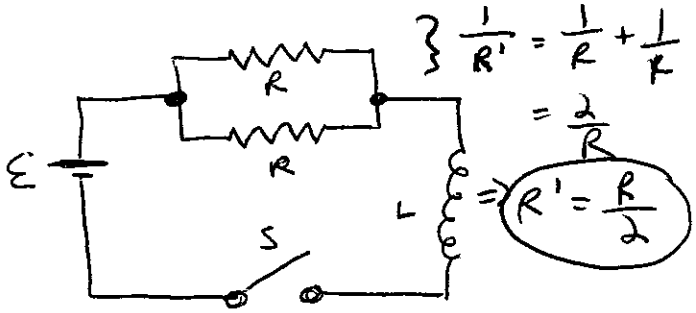
$$= [s] \quad //$$

② In terms of R, L what is the time constant for the following circuits:



a) $\tau = L/R'$

$$\boxed{\tau = \frac{L}{2R}}$$



$\frac{1}{R'} = \frac{1}{R} + \frac{1}{R} = \frac{2}{R}$

b) $\tau = L/R'$

$= L/(R/2)$

$$\boxed{\tau = 2L/R} \quad //$$