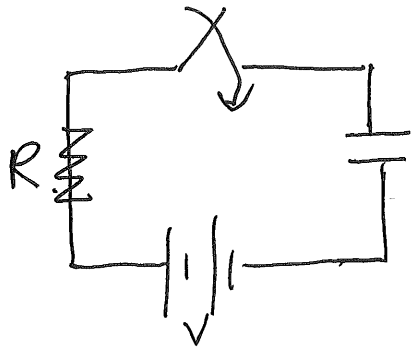
Charging a RC circuit.



$\tau = RC.$

At $t=0$. (Capacitor conducts "perfectly").

$V_c = 0$

$I = \frac{V}{R}$

$V_R = V.$

$Q = 0.$

At $t=\infty$. (Capacitor does not conduct).

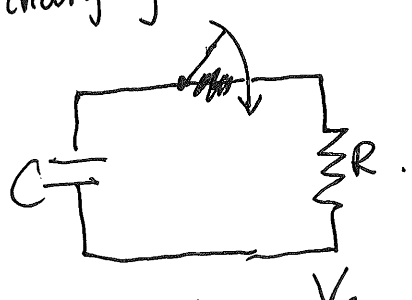
$V_c = V$

$V_R = 0.$

$I = 0.$

$Q = CV.$

Discharging a RC circuit.

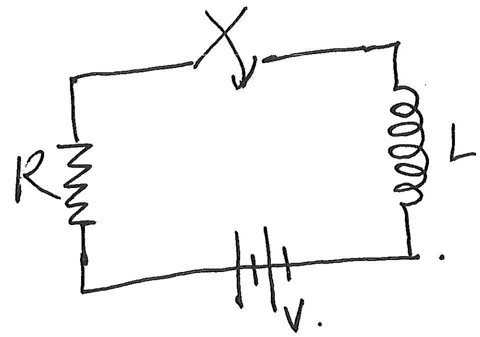


At $t=0$. $I = \frac{V_c}{R}$. $V_R = V_c$. $V_c = \frac{Q}{C}$.

At $t=\infty$. $I=0$. $V_c=0$. $V_R=0$.

Charging a RL circuit.

$\mathcal{E} = -L\frac{dI}{dt}$



$\cancel{\tau = \frac{R}{L}}$

$\tau = \frac{L}{R}.$

At $t=0$. (Inductor does not conduct).

$V_R = \cancel{V}\ 0$

$V_L = V$

$I = 0.$

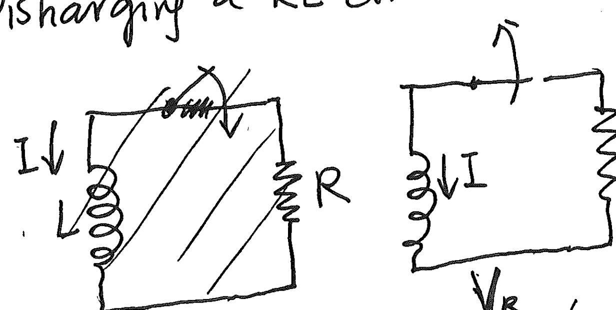
At $t=\infty$. (Inductor conducts "perfectly").

$V_R = V.$

$V_L = 0.$

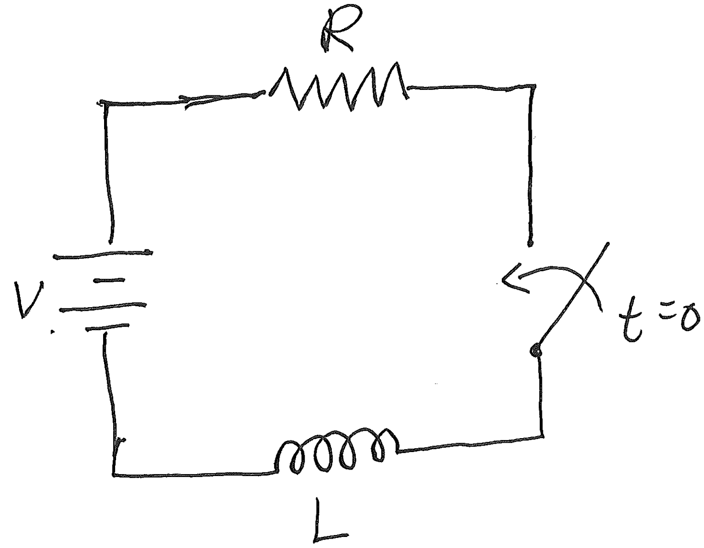
$I = \frac{V}{R}.$

Disharging a RL circuit

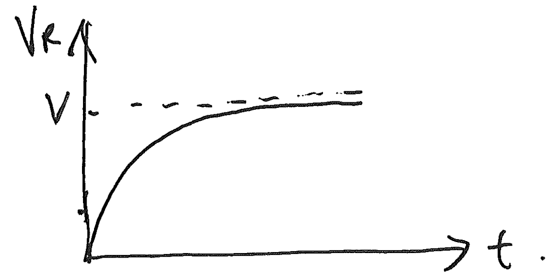


At $t=0$. $I = I_0$. $V_L = \cancel{0}\ V_R$. $V_R = I_0 R$.

At $t=\infty$. $I=0$. $V_L=0$. $V_R=0$.



$V_R = 0$ at $t = 0$.



$V_R = V$ at $t = \infty$.

$$I = \frac{V}{R}\left(1 - e^{-t/\tau}\right). \qquad V_R = V\left(1 - e^{-\frac{t}{\tau}}\right). \qquad \tau = \frac{L}{R}.$$

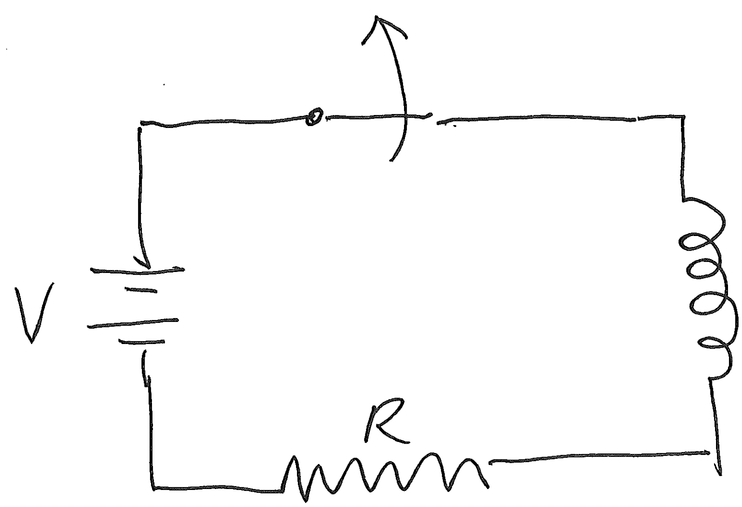
$$V_L = V e^{-t/\tau}.$$

$$I = \frac{\mathcal{E}}{R}\left(1 - e^{-\frac{R}{L}t}\right).$$

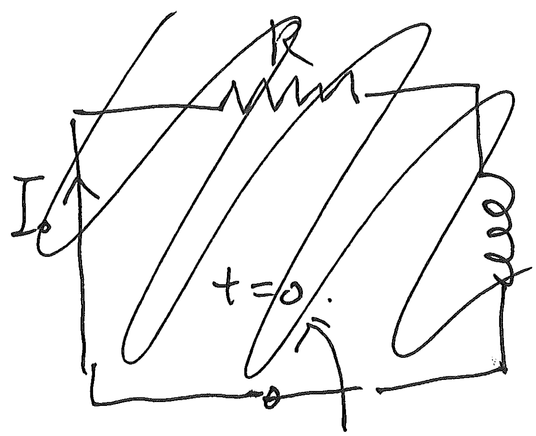
$$= \frac{\mathcal{E}}{R}\left(1 - e^{-\frac{t}{\left(\frac{L}{R}\right)}}\right) \leftarrow \tau.$$

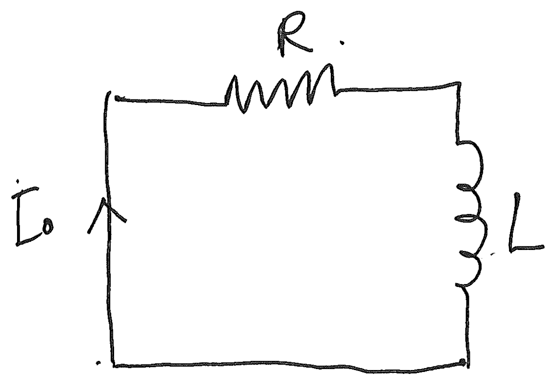
$$\tau = \frac{L}{R}.$$

"Discharging" a RL circuit.



Discharge:





$V_L = ?$

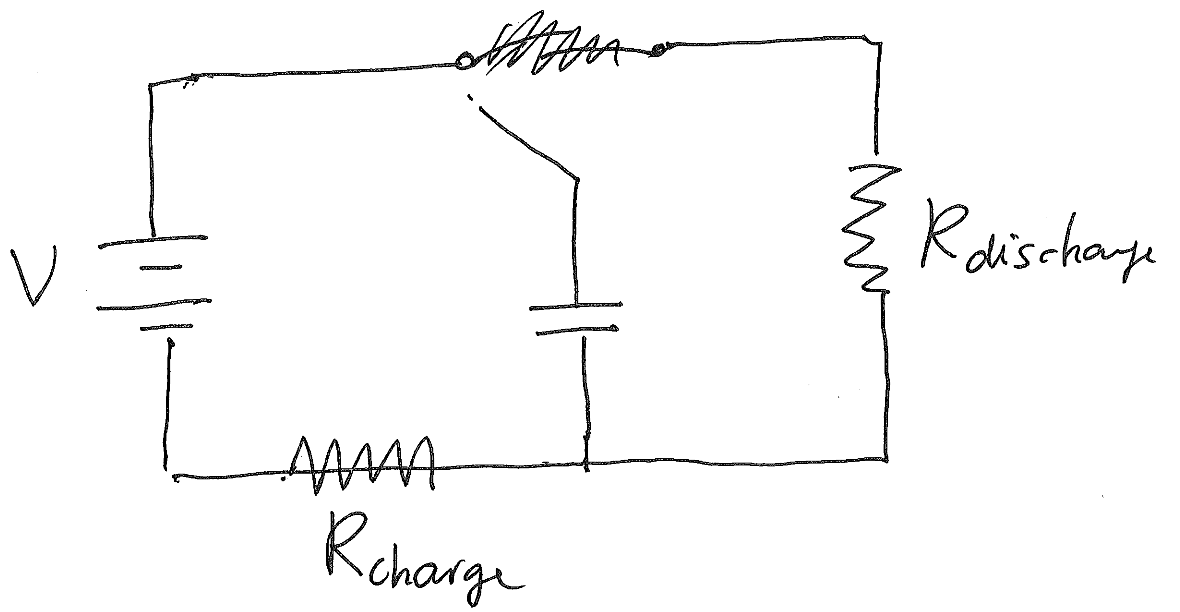
At $t=0$. $V_L = V_R$.

$t=\infty$. $V_L = 0$.

$\therefore V_L = V_R e^{-t/\tau}$ $\qquad \tau = \frac{L}{R}$

$= I_0 R e^{-t/\tau}$.

RC Circuit:



LC Circuit