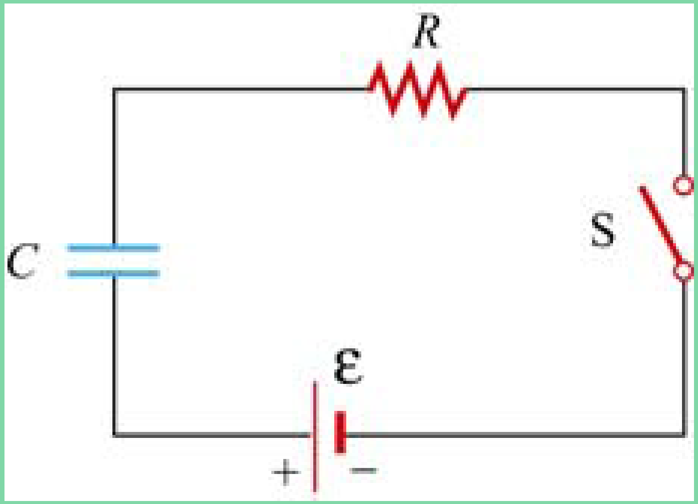
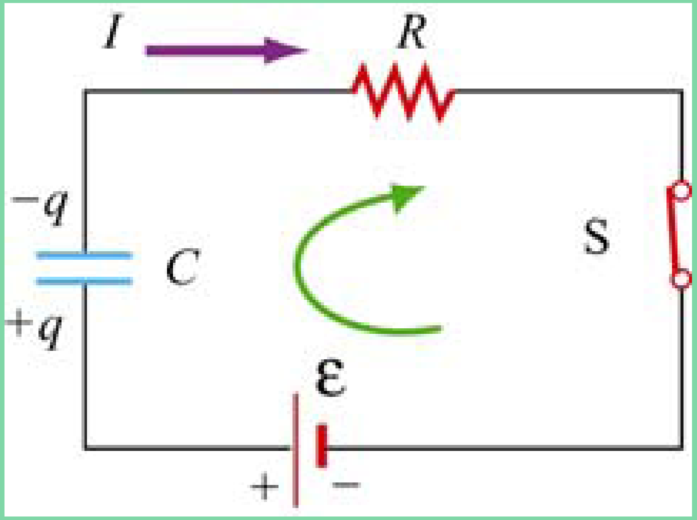
Circuito RC – Carga de un condensador





$$I(t)R = \mathcal{E} - V_C(t)$$

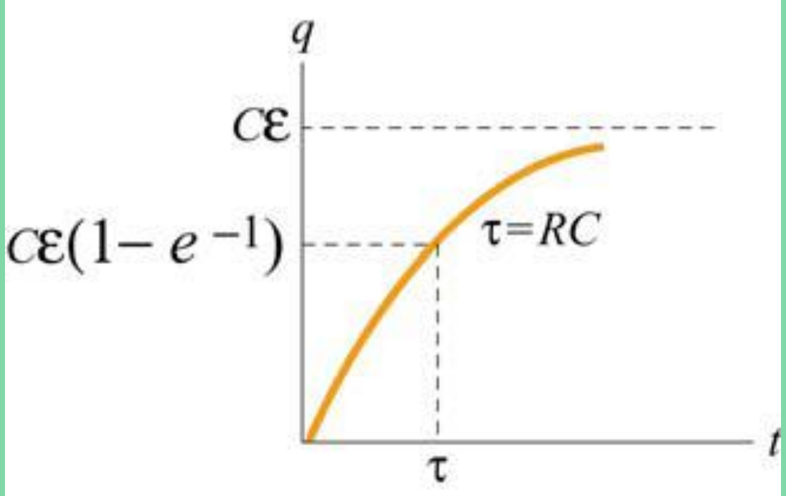
$$0 = \varepsilon - I(t)R - V_C(t)$$
$$= \varepsilon - \frac{dq}{dt}R - \frac{q}{C}$$

$$\frac{dq}{dt} = \frac{1}{R}\left(\varepsilon - \frac{q}{C}\right)$$

$$\frac{dq}{\left(\varepsilon-\dfrac{q}{C}\right)}=\frac{1}{R}dt \quad\Rightarrow\quad \frac{dq}{q-C\varepsilon}=-\frac{1}{RC}dt$$

$$\int_0^q \frac{dq'}{q'-C\varepsilon}=-\frac{1}{RC}\int_0^t dt'$$

$$\ln\left(\frac{q-C\varepsilon}{-C\varepsilon}\right)=-\frac{t}{RC}$$



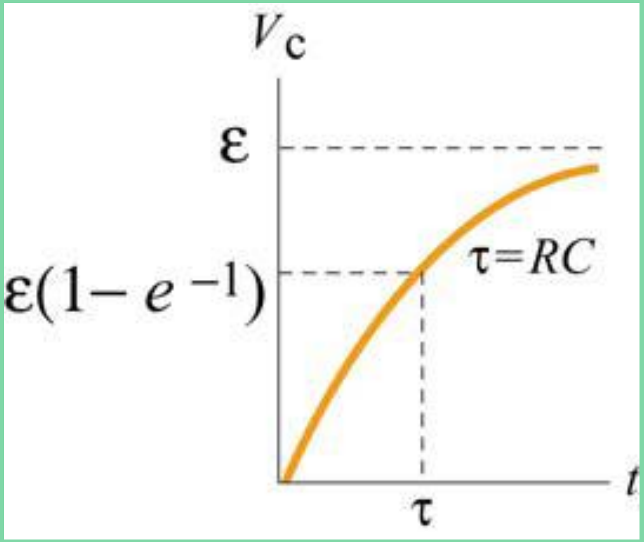
$$\boxed{q(t)=C\varepsilon\left(1-e^{-t/RC}\right)=Q\left(1-e^{-t/RC}\right)}$$

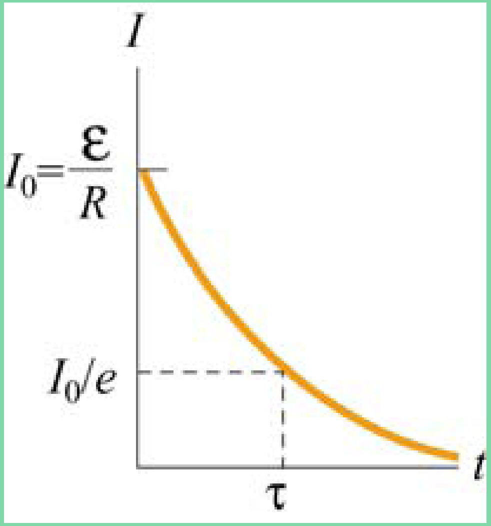
$$V_C(t) = \frac{q(t)}{C} = \varepsilon(1 - e^{-t/RC})$$

$$q(t = \infty) = C\varepsilon = Q$$

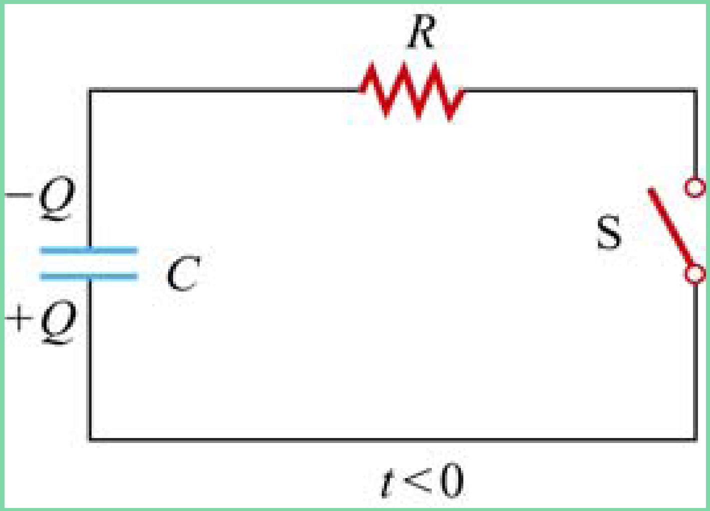
$$V_C = \frac{q(t = \infty)}{C} = \frac{Q}{C} = \varepsilon$$

$$I(t) = \frac{dq}{dt} = \left(\frac{\varepsilon}{R}\right) e^{-t/RC} = I_0\, e^{-t/RC}$$



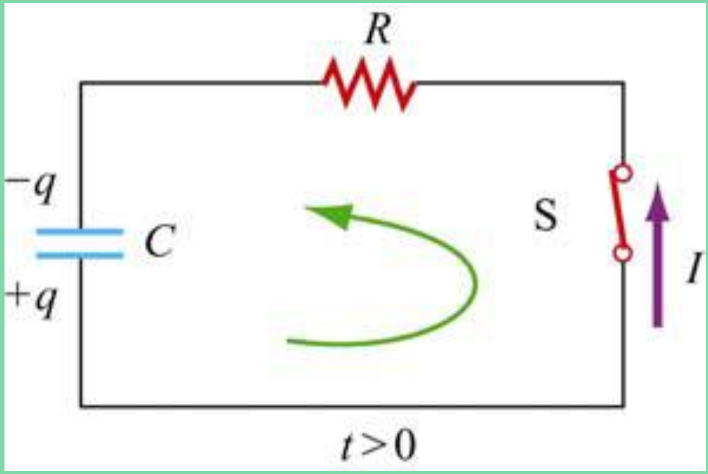


Circuito RC – Descarga de un condensador



$$\frac{q}{C} - IR = 0$$

$$I = -\frac{dq}{dt}$$



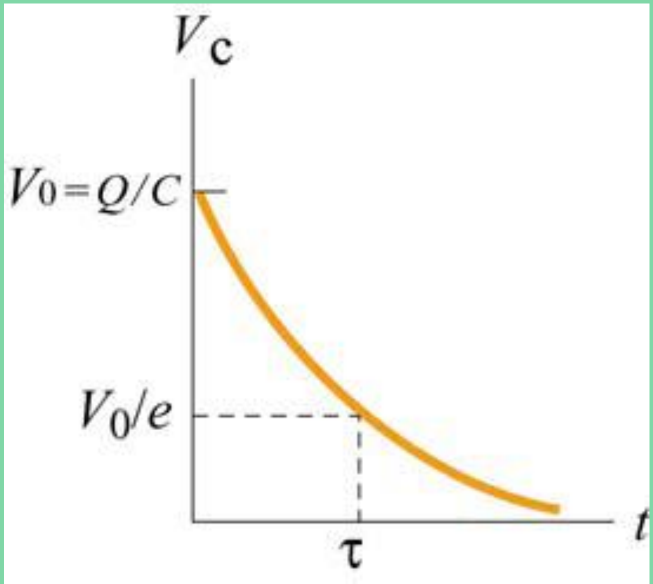
$$\frac{q}{C} + R\frac{dq}{dt} = 0$$

$$\frac{dq}{q} = -\frac{1}{RC}dt$$

$$\int_Q^q \frac{dq'}{q'} = -\frac{1}{RC}\int_0^t dt' \quad \Rightarrow \quad \ln\left(\frac{q}{Q}\right) = -\frac{t}{RC}$$

$$\boxed{q(t) = Q e^{-t/RC}}$$

$$V_C(t) = \frac{q(t)}{C} = \left(\frac{Q}{C}\right) e^{-t/RC}$$



$$I = -\frac{dq}{dt} = \left(\frac{Q}{RC}\right)e^{-t/RC}$$