Answer on Question #66186-Physics-Other

An emf of 100 V is applied to a series RC circuit in which the resistance is 200 ohms and the capacitance is 10-4 farads. Determine the charge q(t) on the capacitor if q(0) = 0. Also determine the current i(t).

Solution

The charge on capacitor is

$$q(t) = Q\left(1 - e^{-\frac{t}{\tau}}\right).$$

$$\tau = RC = (200)(10^{-4}) = 0.02\ s.$$

$$Q = CE = (10^{-4})(100) = 0.01\ C.$$

Thus,

$$q(t) = 0.01(1 - e^{-50t})\ C.$$

The current is

$$i(t) = Ie^{-\frac{t}{\tau}}.$$

$$I = \frac{Q}{\tau} = \frac{0.01}{0.02} = 0.5\ A.$$

Thus,

$$i(t) = 0.5e^{-50t}\ A.$$