Answer on Question #62832, Physics / Electromagnetism

A series circuit consisting of an unchanged 42µF capacitor and 10M ohms resistor is connected to 100V power source. What are the current in the circuit and the charge on the capacitor after one time constant?

Solution:

Charge the capacitor

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

$$q = 42 \cdot 10^{-6} \cdot 1 \cdot (1 - e^{-1}) = 15.6 \ \mu C$$

The current in the circuit

$$I = \frac{U}{R}\left(e^{-\frac{t}{\tau}}\right) = \frac{U}{R}(e^{-1})$$

$$I = \frac{100}{10^7}(e^{-1}) = 0.37 \ \mu A$$

Answer: 0.37 µA and 15.6 µC