

31.39. Model: The capacitor discharges through a resistor. Assume that the wires are ideal.

Solve: The decay of the capacitor charge is given by the Equation 31.38: $Q = Q_0 e^{-t/\tau}$. The time constant is

$$\tau = RC = (1.0 \times 10^3 \Omega)(10 \times 10^{-6} \text{ F}) = 0.010 \text{ s}$$

The initial charge on the capacitor is $Q_0 = 20 \mu\text{C}$ and it decays to $10 \mu\text{C}$ in time t . That is,

$$10 \mu\text{C} = (20 \mu\text{C})e^{-t/0.010 \text{ s}} \Rightarrow \ln\left(\frac{10 \mu\text{C}}{20 \mu\text{C}}\right) = -\frac{t}{0.010 \text{ s}} \Rightarrow t = (0.010 \text{ s}) \ln 2 = 6.93 \text{ ms}$$