58. (a) $\tau = RC = (1.40 \times 10^6\ \Omega)(1.80 \times 10^{-6}\ \text{F}) = 2.52$ s.

(b) $q_o = \varepsilon C = (12.0\ \text{V})(1.80\ \mu\text{F}) = 21.6\ \mu\text{C}$.

(c) The time t satisfies $q = q_0(1 - e^{-t/RC})$, or

$$t = RC\ln\left(\frac{q_0}{q_0 - q}\right) = (2.52\,\text{s})\ln\left(\frac{21.6\,\mu\text{C}}{21.6\,\mu\text{C} - 16.0\,\mu\text{C}}\right) = 3.40\,\text{s}.$$

62. The time it takes for the voltage difference across the capacitor to reach V_L is given by $V_L = \varepsilon\left(1 - e^{-t/RC}\right)$. We solve for R:

$$R = \frac{t}{C\ln\left[\varepsilon/(\varepsilon - V_L)\right]} = \frac{0.500\,\text{s}}{(0.150\times10^{-6}\,\text{F})\ln\left[95.0\,\text{V}/(95.0\,\text{V} - 72.0\,\text{V})\right]} = 2.35\times10^6\,\Omega$$

where we used $t = 0.500$ s given (implicitly) in the problem.

64. (a) The potential difference V across the plates of a capacitor is related to the charge q on the positive plate by $V = q/C$, where C is capacitance. Since the charge on a discharging capacitor is given by $q = q_0\, e^{-t/\tau}$, this means $V = V_0\, e^{-t/\tau}$ where V_0 is the initial potential difference. We solve for the time constant τ by dividing by V_0 and taking the natural logarithm:

$$\tau = -\frac{t}{\ln(V/V_0)} = -\frac{10.0\,\text{s}}{\ln\left[(1.00\,\text{V})/(100\,\text{V})\right]} = 2.17\,\text{s}.$$

(b) At $t = 17.0$ s, $t/\tau = (17.0\ \text{s})/(2.17\ \text{s}) = 7.83$, so

$$V = V_0 e^{-t/\tau} = (100\,\text{V})e^{-7.83} = 3.96\times10^{-2}\ \text{V}\ .$$

65. In the steady state situation, the capacitor voltage will equal the voltage across $R_2 =$ 15 kΩ:

$$V_0 = R_2\frac{\varepsilon}{R_1 + R_2} = (15.0\ \text{k}\Omega)\left(\frac{20.0\,\text{V}}{10.0\ \text{k}\Omega + 15.0\ \text{k}\Omega}\right) = 12.0\,\text{V}.$$

Now, multiplying Eq. 27-39 by the capacitance leads to $V = V_0 e^{-t/RC}$ describing the voltage across the capacitor (and across $R_2 = 15.0$ kΩ) after the switch is opened (at $t = 0$). Thus, with $t = 0.00400$ s, we obtain

$$V = (12)e^{-0.004/(15000)(0.4\times10^{-6})} = 6.16\,\text{V}.$$

Therefore, using Ohm's law, the current through R_2 is 6.16/15000 = 4.11×10^{-4} A.