28.2 (a) $\Delta V_{\text{term}} = IR$

becomes $10.0 \text{ V} = I(5.60 \Omega)$

so $I = \boxed{1.79 \text{ A}}$

(b) $\Delta V_{\text{term}} = \mathcal{E} - Ir$

becomes $10.0 \text{ V} = \mathcal{E} - (1.79 \text{ A})(0.200 \Omega)$

so $\mathcal{E} = \boxed{10.4 \text{ V}}$
If we turn the given diagram on its side, we find that it is the same as Figure (a). The 20.0-Ω and 5.00-Ω resistors are in series, so the first reduction is as shown in (b). In addition, since the 10.0-Ω, 5.00-Ω, and 25.0-Ω resistors are then in parallel, we can solve for their equivalent resistance as:

\[ R_{eq} = \frac{1}{\frac{1}{10.0 \, \Omega} + \frac{1}{5.00 \, \Omega} + \frac{1}{25.0 \, \Omega}} = 2.94 \, \Omega \]

This is shown in Figure (c), which in turn reduces to the circuit shown in (d).

Next, we work backwards through the diagrams applying \( I = \frac{\Delta V}{R} \) and \( \Delta V = IR \). The 12.94-Ω resistor is connected across 25.0-V, so the current through the battery in every diagram is

\[ I = \frac{\Delta V}{R} = \frac{25.0 \, V}{12.94 \, \Omega} = 1.93 \, A \]

In Figure (c), this 1.93 A goes through the 2.94-Ω equivalent resistor to give a potential difference of:

\[ \Delta V = IR = (1.93 \, A)(2.94 \, \Omega) = 5.68 \, V \]

From Figure (b), we see that this potential difference is the same across \( V_{ab} \), the 10-Ω resistor, and the 5.00-Ω resistor.

(b) Therefore, \( V_{ab} = 5.68 \, V \)

(a) Since the current through the 20.0-Ω resistor is also the current through the 25.0-Ω line \( ab \),

\[ I = \frac{V_{ab}}{R_{ab}} = \frac{5.68 \, V}{25.0 \, \Omega} = 0.227 \, A = 227 \, mA \]
\[ R_p = \left( \frac{1}{3.00} + \frac{1}{1.00} \right)^{-1} = 0.750 \Omega \]

\[ R_s = (2.00 + 0.750 + 4.00) \Omega = 6.75 \Omega \]

\[ I_{\text{battery}} = \frac{\Delta V}{R_s} = \frac{18.0 \text{ V}}{6.75 \Omega} = 2.67 \text{ A} \]

\[ P = I^2 R: \quad P_2 = (2.67 \text{ A})^2 (2.00 \Omega) \]

\[ P_2 = 14.2 \text{ W in } 2.00 \Omega \]

\[ P_4 = (2.67 \text{ A})^2 (4.00 \Omega) = 28.4 \text{ W in } 4.00 \Omega \]

\[ \Delta V_2 = (2.67 \text{ A})(2.00 \Omega) = 5.33 \text{ V,} \quad \Delta V_4 = (2.67 \text{ A})(4.00 \Omega) = 10.67 \text{ V} \]

\[ \Delta V_p = 18.0 \text{ V} - \Delta V_2 - \Delta V_4 = 2.00 \text{ V} \quad (= \Delta V_3 = \Delta V_1) \]

\[ \frac{\Delta V_3}{R_3} = \frac{(2.00 \text{ V})^2}{3.00 \Omega} = 1.33 \text{ W in } 3.00 \Omega \]

\[ \frac{\Delta V_1}{R_1} = \frac{(2.00 \text{ V})^2}{1.00 \Omega} = 4.00 \text{ W in } 1.00 \Omega \]
\[ 28.18 \quad +15.0 - (7.00)I_1 - (2.00)(5.00) = 0 \]

\[ 5.00 = 7.00I_1 \quad \text{so} \quad I_1 = 0.714 \text{ A} \]

\[ I_3 = I_1 + I_2 = 2.00 \text{ A} \]

\[ 0.714 + I_2 = 2.00 \quad \text{so} \quad I_2 = 1.29 \text{ A} \]

\[ \begin{array}{c}
\begin{array}{c}
7.00 \Omega \\
5.00 \Omega \\
2.00 \Omega
\end{array}
\begin{array}{c}
15.0 \text{ V} \\
\Delta \\
\varepsilon
\end{array}
\end{array} \]

\[ +\varepsilon - 2.00 (1.29) - (5.00)(2.00) = 0 \quad \varepsilon = 12.6 \text{ V} \]

\[ 28.24 \quad \text{Name the currents as shown in the figure to the right.} \quad \text{Then} \quad w + x + z = y. \quad \text{Loop equations are} \]

\[ -200w - 40.0 + 80.0x = 0 \]

\[ -80.0x + 40.0 + 360 - 20.0y = 0 \]

\[ +360 - 20.0y - 70.0z + 80.0 = 0 \]

\[ \begin{array}{c}
w \quad x \quad y \quad z
\end{array} \]

Eliminate \( y \) by substitution.

\[ \begin{array}{c}
x = 2.50w + 0.500 \\
400 - 100x - 20.0w - 20.0z = 0 \\
440 - 20.0w - 20.0x - 90.0z = 0
\end{array} \]

Eliminate \( x \): \quad \begin{array}{c}
350 - 270w - 20.0z = 0 \\
430 - 70.0w - 90.0z = 0
\end{array} \]

Eliminate \( z = 17.5 - 13.5w \) to obtain \( 430 - 70.0w - 1575 + 1215w = 0 \)
\[ w = \frac{70.0}{70.0} = 1.00 \text{ A upward in 200 } \Omega \]

Now
\[ z = \frac{4.00 \text{ A upward in 70.0 } \Omega}{} \]

\[ x = \frac{3.00 \text{ A upward in 80.0 } \Omega}{} \]

\[ y = \frac{8.00 \text{ A downward in 20.0 } \Omega}{} \]

and for the 200 \( \Omega \),
\[ \Delta V = IR = (1.00 \text{ A})(200 \Omega) = 200 \text{ V} \]

\textbf{28.30} (a) \[ I(t) = -I_0 e^{t/RC} \]

\[ I_0 = \frac{Q}{RC} = \frac{5.10 \times 10^{-6} \text{ C}}{(1300 \Omega)(2.00 \times 10^{-9} \text{ F})} = 1.96 \text{ A} \]

\[ I(t) = -(1.96 \text{ A}) e^{\left[\frac{-9.00 \times 10^{-6} \text{ s}}{(1300 \Omega)(2.00 \times 10^{-9} \text{ F})}\right]} = -61.6 \text{ mA} \]

(b) \[ q(t) = Qe^{t/RC} = (5.10 \mu\text{C}) e^{\left[\frac{-8.00 \times 10^{-6} \text{ s}}{(1300 \Omega)(2.00 \times 10^{-9} \text{ F})}\right]} = 0.235 \mu\text{C} \]

(c) The magnitude of the current is \[ I_0 = 1.96 \text{ A} \]