Reduction of the network is accomplished as follows:

\[ 2R = R + R \]
\[ 2R/R = \frac{2R^2}{2R} = \frac{2}{3}R \]
\[ \frac{2}{3}R + R = \frac{5}{3}R \]
\[ \frac{5}{3}R/R = \frac{\frac{5}{3}R^2}{\frac{5}{3}R} = \frac{5}{8}R \]
\[ \frac{5}{8}R + R = \frac{13}{8}R = \frac{13}{8}(2.8) \text{ kA} = 4.55 \text{ kA} \]

Problem #20

(a) For the two in front of the switch, the voltage drop increases. For the resistor behind the switch, the voltage drop goes to zero.

(b) For the two in front, it increases and for the one behind the switch, the current drops to zero.

(c) The terminal voltage increases slightly.

(d) \[ R_{eq} = \frac{R^2}{2R} + R = \frac{3}{2}R \], \[ I = \frac{V}{\frac{3}{2}R + 5} = \frac{12}{8.75} = 1.37 \text{ A} \]
\[ V_r = \frac{5}{8}(1.37) = .68 \]
\[ V_{term} = 12 - .68 = 11.32 \text{ V} \]

\[ I = \frac{12}{11.5} = 1.04 \text{ A} \]
\[ V_r = \frac{5}{10.4} = .52 \]
\[ V_{term} = 12 - .52 = 11.48 \text{ V} \]
Electricity, Magnetism & Light
Series 26 - DC Circuits
Solutions to Homework Set # 6

**Prob #23**

\[
I = \frac{9}{2+12+8} = \frac{9}{22} = .409 \text{ A}
\]

\[
\begin{align*}
V_2 &= 2(.409) = .818V, \\
V_6 &= 3(.409) = 3.272V, \\
V_{12} &= 12(.409) = 4.908V.
\end{align*}
\]

\[
\sum = 8.998 \approx 9.0V
\]

**Prob #29**

Write three loop-current equations:

\[
\begin{align*}
6 - 2(5(I_1 + I_2)) - 2(I_1 + I_3) &= 0 \\
-20I_2 - 25(I_1 + I_2) - 10(I_2 - I_3) &= 0 \\
-2I_3 - 10(I_3 - I_2) - 2(I_3 + I_1) &= 0
\end{align*}
\]

\[
\begin{align*}
27I_1 + 25I_2 + 2I_3 &= 6 \\
25I_1 + 55I_2 - 10I_3 &= 0 \\
2I_1 - 10I_2 + 14I_3 &= 0
\end{align*}
\]

Solve these simultaneously to get

\[
\begin{align*}
I_1 &= .495 \text{ A} \\
I_2 &= -.273 \text{ A} \\
I_3 &= -.266 \text{ A}
\end{align*}
\]

\[
\begin{align*}
I_{20} &= -I_2 = .273 \text{ A} \\
I_{10} &= .007 \text{ A} \\
I_{25} &= I_1 + I_2 = .222 \text{ A} \\
I_{260} &= .229 \text{ A} \\
I_{240} &= -I_3 = .266 \text{ A} \\
I &= I_1 = .496 \text{ A}
\end{align*}
\]