1. Find the voltages $V_{ab}$, $V_{bc}$, and $V_{ac}$. Be sure to include the proper signs and units.

\[
I_{x} = \frac{6A}{4} = \frac{3A}{2}
\]

\[
V_{x} = I_{x}R = 3A \times 2V = 6V
\]

16 pts

**USING KCL AT POINT X:**

\[
I_{y} = 6A - 2A = 4A
\]

\[
V_{y} = I_{y}R = 4A \times 2V = 8V
\]

So:

\[
V_{ab} = -4V - 8V + 20V - 22V = -14V = [\boxed{-14V = V_{ab}}]
\]

\[
V_{bc} = +12V - 24V - 20V + 8V + 4V = -20V = [\boxed{-20V = V_{bc}}]
\]

\[
V_{ac} = +12V - 24V - 22V = -34V = [\boxed{-34V = V_{ac}}]
\]
2. Find the total equivalent resistance

\[ R_{EQ} = \frac{1}{\frac{1}{2\Omega} + \frac{1}{3\Omega} + \frac{1}{6\Omega}} = 10\Omega \]

\[ \frac{1}{2\Omega} + \frac{1}{3\Omega} + \frac{1}{6\Omega} = \frac{1}{2}\Omega + \frac{1}{3}\Omega = \frac{5}{6}\Omega \]

\[ 12\Omega / 5\Omega = \frac{12}{12+6} = \frac{2}{3} \]

\[ R_{EQ} = 4\Omega + 4\Omega = 8\Omega \]

16 pts
3. Resistor R1 dissipates 35 watts and resistor R2 dissipates 23 watts when they are connected in series across a 25 volt supply. Find how much power each resistor will dissipate when they are connected in parallel across a 15 volt supply.

\[ P_{R1} = 35W + 23W = 58W \]

\[ P = \frac{V^2}{R} \]

\[ I = \frac{P}{V} = \frac{58W}{25V} = 2.32A \]

\[ R = \frac{V}{I} \]

\[ R_1 = \frac{35W}{(2.32A)^2} = 6.5\Omega \]

\[ R_2 = \frac{23W}{(2.32A)^2} = 4.22\Omega \]

16 pts

For V = 15V:

\[ P_{R1} = \frac{V^2}{R} = \frac{(15V)^2}{6.5\Omega} = \boxed{34.6W} = P_{R1} \]

\[ P_{R2} = \frac{V^2}{R} = \frac{(15V)^2}{4.22\Omega} = \boxed{52.7W} = P_{R2} \]
4. A college student's 24 hour electrical energy usage was 7.5 KWH last Saturday. His computer uses 420 watts, his room lights use 275 watts, and his television uses 350 watts. He used no electricity while sleeping for 8 hours, used his computer for 6 hours, and had his lights on for 8 hours. If electricity cost 10 cents per kilowatt-hour, how much did it cost the student to have his TV on?

\[
\begin{align*}
\text{Computer:} & \quad (0.42 \text{ kW})(6 \text{ hrs}) = 2.52 \text{ KWH} \\
\text{Lights:} & \quad (0.275 \text{ kW})(8 \text{ hrs}) = 2.20 \text{ KWH} \\
\text{Total:} & \quad 4.72 \text{ KWH} \\
\text{TV:} & \quad 7.5 \text{ KWH} - 4.72 \text{ KWH} = 2.78 \text{ KWH} \\
\text{TV Cost:} & \quad (2.78 \text{ KWH})(0.10 / \text{KWH}) = 0.278 \text{ dollars}
\end{align*}
\]

16 pts
5. Find the power dissipated in each resistor

\[ R_{eq} = \frac{14\Omega}{126\Omega + 14\Omega} = \frac{14\Omega}{140\Omega} = 0.10 \text{ ohms} \]

\[ V_{ab} = IR = (10\text{A})(10.625\Omega) = 106.25\text{V} \]

\[ P_{14\Omega} = \frac{V^2}{R} = \frac{(106.25\text{V})^2}{14\Omega} = 805.625\text{W} = P_{14\Omega} \]

\[ I = \frac{V}{R} = \frac{106.25\text{V}}{14\Omega} = 7.614\text{A} \]

\[ P = I^2R \]

\[ P_{26\Omega} = (7.614\text{A})^2(26\Omega) = 1151.5\text{W} = P_{26\Omega} \]

\[ P_{18\Omega} = (7.614\text{A})^2(18\Omega) = 104.9\text{W} = P_{18\Omega} \]

CHECK! \[ 805.625\text{W} + 1151.5\text{W} + 104.9\text{W} = 1062\text{W} \]

AND \[ (10\text{A})(106.25\text{V}) = 1062\text{W} \]
6. Find the current $I$

\[
\begin{align*}
I &= \frac{V}{R} = \frac{100\,V}{10.58\,\Omega} = \frac{100\,V}{16.58\,\Omega} = \frac{100\,V}{24\,\Omega} = 1.5382\,A \\
V_{ab} &= I A = (5.382A)(10.58\,\Omega) = 56.54\,V \\
V_{bc} &= I A = (5.382A)(8\,\Omega) = 43.06\,V \\
I_{28\,\Omega} &= \frac{V}{R} = \frac{56.54\,V}{28\,\Omega} = 2.034\,A \\
I_{12\,\Omega} &= \frac{V}{R} = \frac{43.06\,V}{12\,\Omega} = 3.588\,A \\
I &= I_{28\,\Omega} - I_{12\,\Omega} = 2.034\,A - 3.588\,A \\
\boxed{I} &= -1.55\,A
\end{align*}
\]