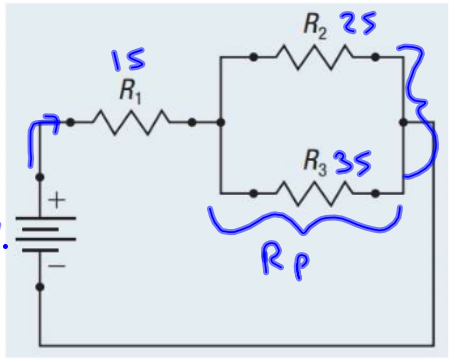
SPH3U 11.9 Circuit Analysis

1. Circuit analysis when resistance values are given

The circuit below has a source voltage of 12.0 V and resistance values of R_1 = 15.0 Ω, R_2 = 25.0 Ω, R_3 = 35.0 Ω. Find values for I_{source}, I_1, I_2, I_3, V_1, V_2, V_3, and R_{total}.



① $V = IR = 6.08\ V$
$I = I_{source} = 0.406\ A.$
$R = 15.0\ \Omega$

② $V = 12 - 6.08 = 5.92\ V$
$I = \frac{V}{R} = \frac{5.92}{25} = 0.237\ A$
$R = 25.0\ \Omega$

③ $V = V_2 = 5.92\ V$
$I = \frac{V}{R} = \frac{5.92}{35} = 0.169\ A.$
$R = 35.0\ \Omega$

Total $V_{source} = 12.0\ V.$
$I_{source} = \frac{V}{R} = \frac{12}{29.583} = 0.406\ A$
$R_{Total} = 29.6\ \Omega.$

$\frac{1}{R_p} = \frac{1}{R_2} + \frac{1}{R_3}$

$= \frac{1}{25} + \frac{1}{35} = \frac{12}{175}$

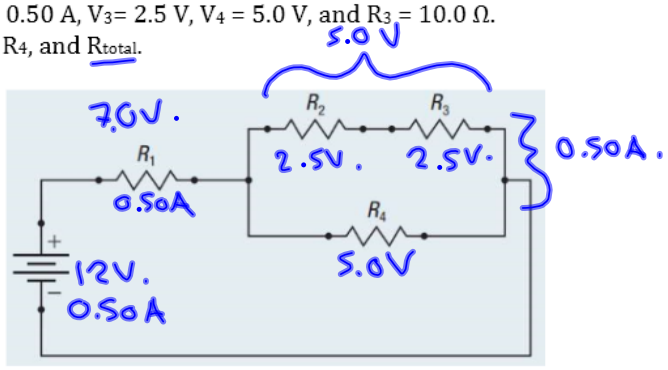
$R_p = \frac{175}{12} = 14.583\ \Omega$

$R_T = 15.0\ \Omega + 14.583\ \Omega$

$= 29.583\ \Omega$

2. Circuit analysis when only some resistance values are given

The circuit below has a V_{source} = 12.0 V, I_1 = 0.50 A, V_3= 2.5 V, V_4 = 5.0 V, and R_3 = 10.0 Ω. Find values for I_{source}, I_2, I_3, I_4, V_1, V_2, R_1, R_2, R_4, and R_{total}.



① $V = V_{source} - V_4 = 7.0V$.
$I = 0.50A$
$R = \frac{V}{I} = \frac{7.0}{0.5} = 14\Omega$.

② $V = 5.0V - V_3 = 2.5V$.
$I = I_3 = 0.25A$.
$R = \frac{V}{I} = \frac{2.5}{0.25} = 10\Omega$

③ $V = 2.5V$
$I = \frac{V}{R} = \frac{2.5}{10} = 0.25A$.
$R = 10.0\Omega$

④ $V = 5.0V$
$I = I_{source} - I_2 = 0.5 - 0.25 = 0.25A$.
$R = \frac{V}{I} = \frac{5.0}{0.25} = 20\Omega$.

Total. $V_{source} = 12.0V$
$I_{source} = I_1 = 0.50A$.
$R_{Total} = \frac{V}{I} = \frac{12}{0.50} = 24\Omega$.

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