A

Practice Problems

1. Determine the total resistance, total current, and the currents through each branch of the following circuit.

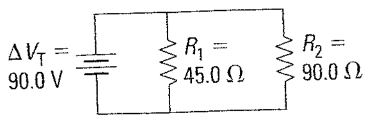


Figure 11.29

2. Determine the total resistance, total current, and the currents through each branch of the following circuit.

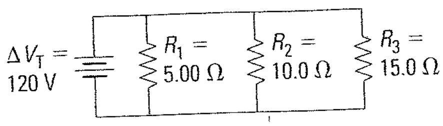


Figure 11.30

Answers

1. $R_T = 30.0\ \Omega$, $I_1 = 2.00$ A, $I_T = 3.00$ A, $I_2 = 1.00$ A
2. $R_T = 2.73\ \Omega$, $I_2 = 12.0$ A, $I_T = 44.0$ A, $I_3 = 8.00$ A, $I_1 = 24.0$ A

B

Practice Problems

1. Determine the current and potential difference through each resistor in Figure 11.38.

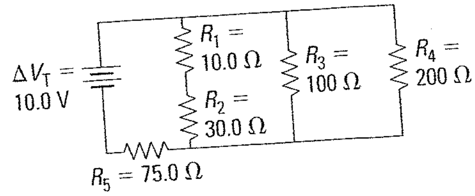


Figure 11.38

2. Determine the current and potential difference through each resistor in Figure 11.39.

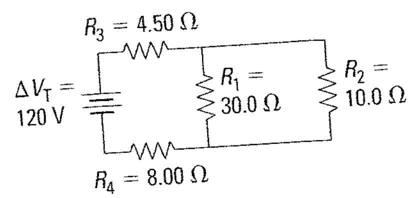


Figure 11.39

Answers

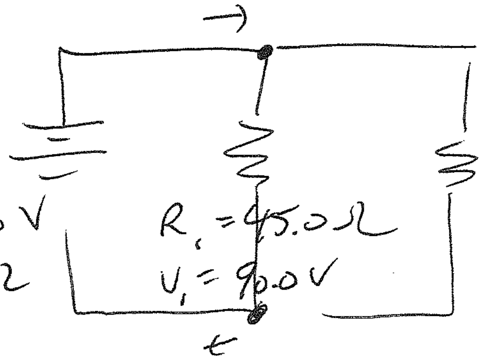
1. $I_1 = 0.0625$ A, $I_2 = 0.0625$ A, $I_3 = 0.0250$ A, $I_4 = 0.0125$ A, $I_5 = 0.100$ A, $\Delta V_1 = 0.625$ V, $\Delta V_2 = 1.88$ V, $\Delta V_3 = 2.50$ V, $\Delta V_4 = 2.50$ V, and $\Delta V_5 = 7.50$ V
2. $I_1 = 1.50$ A, $I_2 = 4.50$ A, $I_3 = 6.00$ A, $I_4 = 6.00$ A, $\Delta V_1 = 45.0$ V, $\Delta V_2 = 45.0$ V, $\Delta V_3 = 27.0$ V, and $\Delta V_4 = 48.0$ V

Table 11.5 outlines the steps you can use to analyze mixed circuits when the resistances are known.

Table 11.5 Simplifying a Mixed Circuit

Step	**Procedure**
Step 1	Reduce the circuit to a simple series circuit by using equivalent resistors.
Step 2	Determine the total resistance and total current of the series circuit using the equation for R_T for series circuits and Ohm's law.
Step 3	Determine the voltage drop across each resistor in the circuit using Ohm's law.
Step 4	Redraw the original circuit with the voltage drops beside each resistor. Remember that the voltage drop across the parallel resistors will be the same.
Step 5	Determine the current through the parallel resistors using Ohm's law.

①



$R_2 = 90.0\,\Omega$
$V_2 = 90.0\,V$

$V_S = 90.0\,V$ $R_1 = 45.0\,\Omega$
$R_S = 30\,\Omega$ $V_1 = 90.0\,V$

$$\frac{1}{R_{EQ}} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$= \frac{1}{45} + \frac{1}{90}$$ can use decimals too!

$$= \frac{3}{90}$$ But $\frac{1}{45} = \frac{2}{90}$ easy 2

$$\frac{1}{R_{EQ}} = \frac{3}{90}$$

$$\therefore R_{EQ} = \frac{90}{3} = 30\,\Omega$$

$V_S = 90.0V \;\therefore\; V_1 = 90.0V$
$V_2 = 90.0V$

KVL

$$I = \frac{V}{R}$$

$$\therefore I_S = \frac{90}{30} = 3.00\,A$$

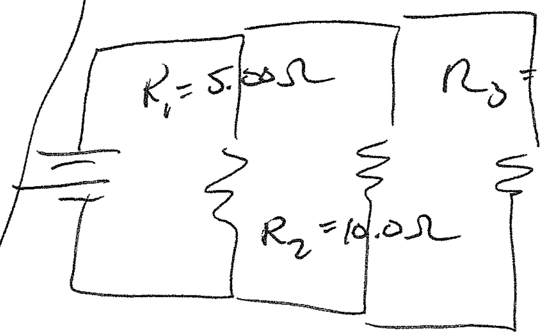
$$I_1 = \frac{90}{45} = 2.00\,A$$

$$I_2 = \frac{90}{90} = 1.00\,A$$

current into (3.00 A) junction = current out (3.00 A)

Ⓐ

② $V = IR$



$R_1 = 5.00\,\Omega$ $R_2 = 10.0\,\Omega$ $R_3 = 15.0\,\Omega$

* Label circuit or create chart as you go

	source	1	2	3
R	2.73	5.00	10.0	15.0
V	120V	120V	120	120
I	44.0A	24	12	8

$$\frac{1}{R_{EQ}} = \frac{1}{5} + \frac{1}{10} + \frac{1}{15}$$

$$= \frac{6}{30} + \frac{3}{30} + \frac{2}{30} = \frac{11}{30}$$

$$R_E = \frac{30}{11} = 2.73\,\Omega = R_S$$

$$\therefore I_S = \frac{V}{R} = \frac{120}{2.73} = 44.0\,A$$

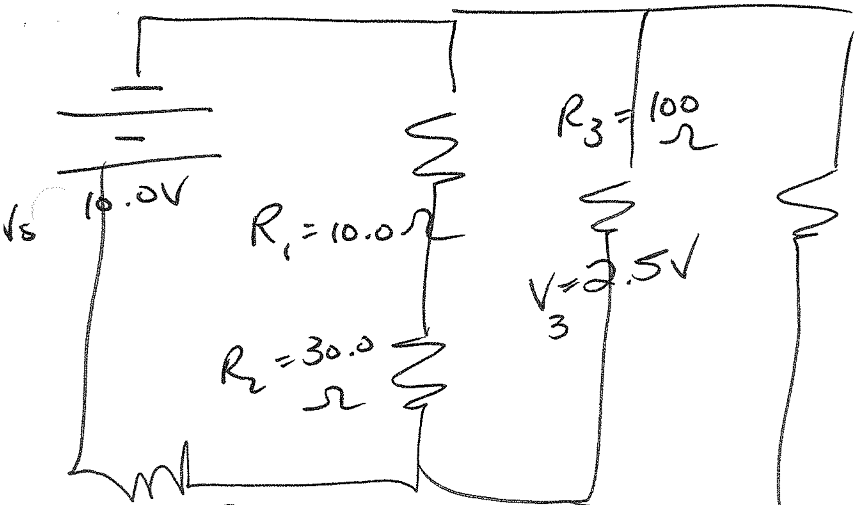
$I_1 = 120/5 = 24$

$I_2 = 120/10 = 12$

$I_3 = 120/15 = 8$

$V = IR$

B



$R_4 = 200\,\Omega$
$V_4 = 2.5V$

$R_5 = 75\,\Omega$
$V_5 = 7.50V$

	Source	1	2	3	4	5
R	18.2 Ω	10	30	100	200	75
V	10.0 V	0.625 V	1.88 V	2.5 V	2.5 V	7.50 V
I	0.100 A	0.0625 A	0.0625 A	0.0250 A	0.0125 A	0.100 A

Find $R_{EQ} = R_S$ Multistep!
- 1st → Combine R_1/R_2
- 2nd → Combine R_1/R_2 with R_3, R_4
- 3rd → Combine $R_1/R_2/R_3/R_4$ with R_5!

R_1 with R_2 — series (10.0 Ω, 30.0 Ω)

$$R_{eq} = 10.0\,\Omega + 30.0\,\Omega = 40.0\,\Omega$$

R_1/R_2 with $R_3 + R_4$ — parallel (40 Ω, 100 Ω, 200 Ω)

$$\frac{1}{R_{EQ}} = \frac{1}{40} + \frac{1}{100} + \frac{1}{200}$$

$$= 0.025 + 0.01 + 0.005$$

$$= 0.04$$

$$\therefore R_e = \frac{1}{0.04} = 25\,\Omega$$

$R_1/R_2/R_3/R_4$ with R_5 $R_{EQ} = 25.0 + 75.0 = 100\,\Omega$

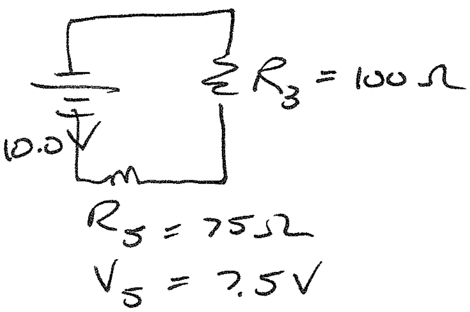
$I_5 = \frac{V_5}{R_5} = \frac{10.0}{100} = 0.100\ A$

$R_5 = R_{eq}$ of simplified circuit

$\therefore I_5 = 0.100\ A$ KCL

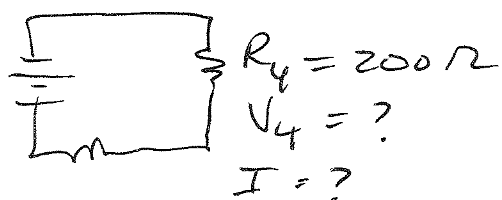
$V_5 = IR$
$= (0.100)(75) = 7.5\ V$

look @ 1 branch of circuit



$V_s = V_3 + V_5$ KVL
$10.0 = V_3 + 7.5$
$V_3 = 2.5\ V$

look @ another branch



KVL $V_S = V_4 + V_5$
$10.0 = V_4 + 7.5$
$V_4 = \underline{2.5V}$

I don't know how 1 & 2 share voltage

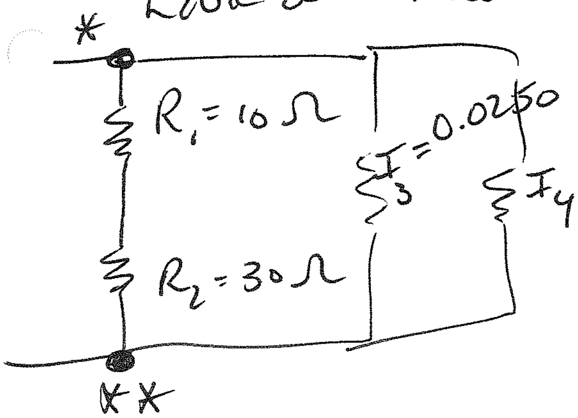
Current

#3 $I_3 = \frac{V_3}{R_3} = \frac{2.5V}{100} = 0.0250\ A$

#4 $I_4 = V_4/R_4 = \frac{2.5}{200} = 0.0125\ A$

OK... current & voltage thru 1 & 2

Look @ this branch.



(KCL) ⇒ current going in to junction* (0.100 A) = current going out of junction **

$I_S = 0.100\,A$ (going in)

$\therefore\ 0.100 = 0.0250 + 0.0125 + I_{1/2}$

(#3) (#4) (thru #1 and #2) - same b/c in series

$\therefore\ I_{1/2} = 0.100 - 0.0375$

$I_{1/2} = 0.0625\,A$

OK $V = IR$

$V_1 = I_1 R_1 = (0.0625)(10) = 0.625\,V$

$V_2 = I_2 R_2 = (0.0625)(30) = 1.88\,V$