KEY

Principles of Engineering
Carman-Ainsworth High School: Mr. Demick
Unit 1.2 Practice Test (*5 assignment points*)
Electrical Circuitry: Series and Parallel Circuits

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Directions: You may use your POE formula sheet for this test and a standard calculator (no phones or music players). Organized and neatly, **you must show all work, including the original** formulas, each step of the calculations, units, and proper labeling. Put your answers in proper engineering notation and use the correct units. Label and circle all answers. Failure to complete any of the above will result in a loss of credit.

Circuit #1: Series Circuits (5 points)

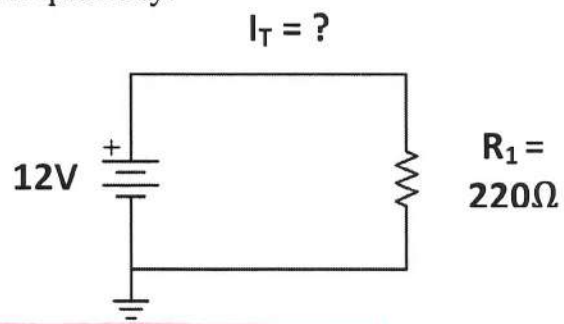
1. Use Ohm's Law to calculate the unknown quantity.

$V = IR$

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

$I = \frac{12V}{220\Omega}$

$I = 0.05454A$



$I = 54.5mA$

2. Use Ohm's Law to calculate the unknown quantity.

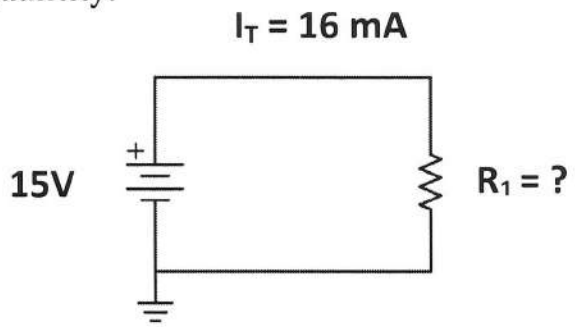
$V = IR$

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

$R = \frac{15V}{0.016A}$

$R = 937.5\Omega$

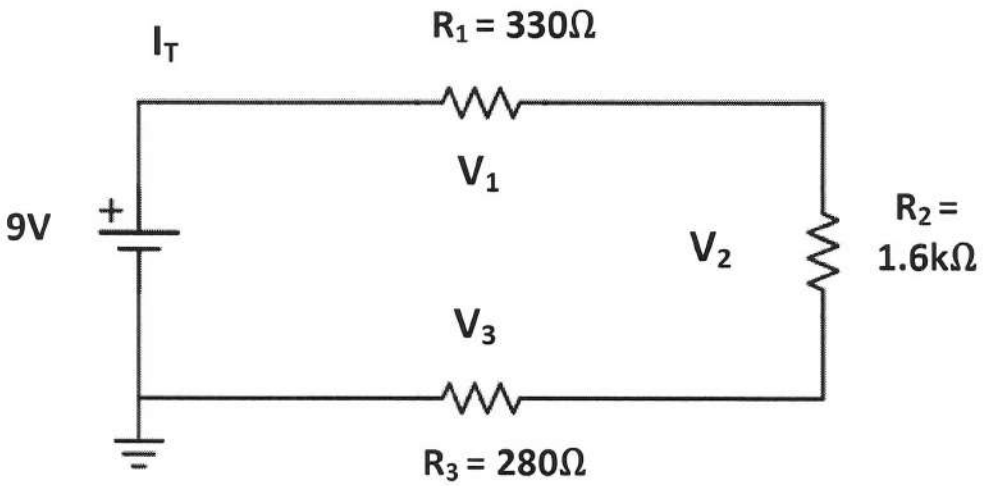
$= 0.94K\Omega$



Circuit #2: Series Circuit (10 points)

For the circuit below, showing all work in the spaces provided, calculate the following:

1. The total resistance (R_T).
2. The *current* flowing *through* each component (I_T, I_1, I_2, and I_3).
3. The *voltage across* each component (V_T, V_1, V_2, and V_3).
4. Use the data to verify Kirchhoff's Voltage Law.



1. Find the total resistance (R_T).

$R_T = R_1 + R_2 + R_3$

$= 330 + 1600 + 280$

$= 2210\Omega$ OR $2.21K\Omega$

2. Find the *current* flowing *through* each component (I_T, I_1, I_2, and I_3).

$I_T = I_1 = I_2 = I_3$

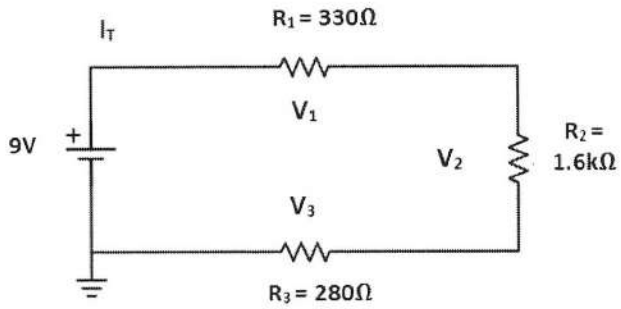
$V = IR$

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

$I = \frac{9V}{2210\Omega}$

$I = 0.00407A$

$I_T = 4.07mA$



3. Find the *voltage across* each component (V_T, V_1, V_2, and V_3).

$V_1 = I_1 R_1$

$= (0.00407A)(330\Omega)$

$V_1 = 1.3431V$

$V_2 = I_2 R_2$

$= (0.00407A)(1600\Omega)$

$V_2 = 6.512V$

$V_3 = I_3 R_3$

$= (0.00407A)(280\Omega)$

$V_3 = 1.1396V$

4. Using the data from problems 1-3, verify Kirchhoff's Voltage Law.

$V_T = V_1 + V_2 + V_3$

$9V = 1.3431 + 6.512 + 1.1396$

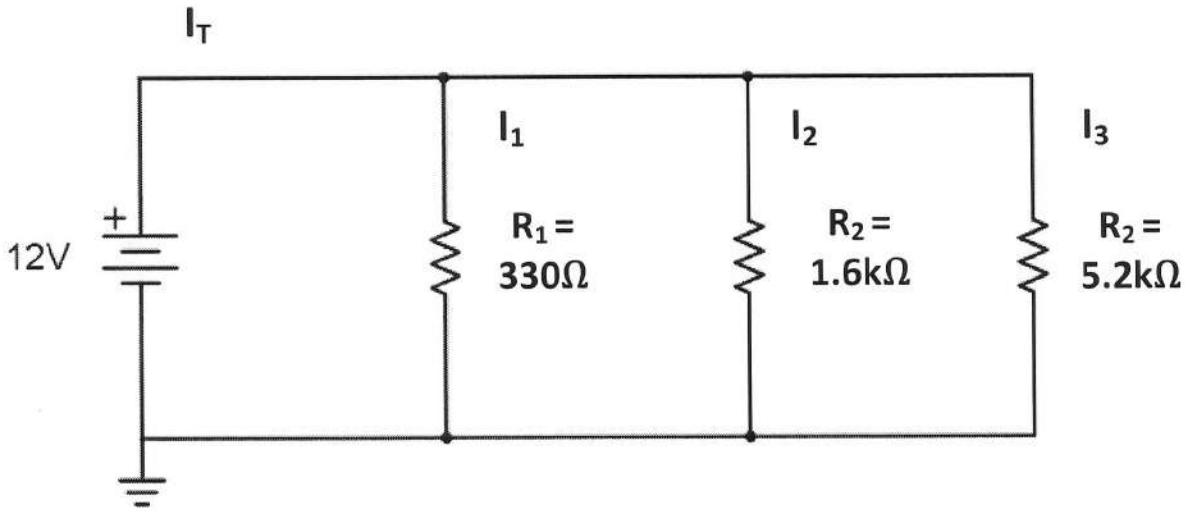
$9V = 8.9947V$

$9V = 9V$ ✓

Circuit #3: Parallel Circuit (10 points)

For the circuit below, showing all work in the spaces provided, calculate the following:

1. The total resistance (R_T).
2. The *voltage across* each component (V_T, V_1, V_2, and V_3).
3. The *current* flowing *through* each component (I_T, I_1, I_2, and I_3).
4. Use the data to verify Kirchhoff's Current Law.



1. Find the total resistance (R_T).

$$R_T = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$$

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$$= \frac{1}{\frac{1}{330} + \frac{1}{1600} + \frac{1}{5200}}$$

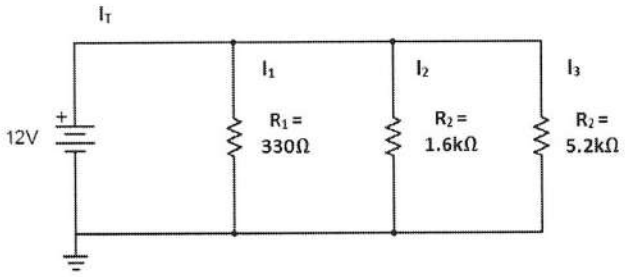
$$R_T = 259.902\,\Omega$$

2. Find the *voltage across* each component (V_T, V_1, V_2, and V_3).

$$V_T = V_1 = V_2 = V_3 = 12V$$

(for parallel circuits)

3. Find the *current* flowing *through* each component (I_T, I_1, I_2, and I_3).



$I_1 = \frac{V_1}{R_1}$

$= \frac{12V}{330\Omega}$

$I_1 = 0.03636A$

$= 36.36mA$

$I_2 = \frac{V_2}{R_2}$

$= \frac{12V}{1600\Omega}$

$I_2 = 0.0075A$

$= 7.5mA$

$I_3 = \frac{V_3}{R_3}$

$= \frac{12V}{5200\Omega}$

$I_3 = 0.00231A$

$= 2.31mA$

$I_T = \frac{V_T}{R_T}$

$= \frac{12V}{259.91\Omega}$

$I_T = 0.04617A$

$= 46.17mA$

4. Using the data from problems 1-3, verify Kirchhoff's Current Law.

$I_T = I_1 + I_2 + I_3$

$46.17mA = 36.36 + 7.5 + 2.31$

$46.17mA = 46.17mA$ ✓