

Name: _____

Date: _____

Section

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The Masters School

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Physics



Circuitry II

1. Three resistors of $100\ \Omega$, $140\ \Omega$, and $80\ \Omega$ are placed in a series circuit.
a. Find the equivalent resistance. (Your answer should be between $0 - 500\ \Omega$)

$$R_{eq} = R_1 + R_2 + \dots + R_n$$

$$= 100 + 140 + 80 = \boxed{320\ \Omega}$$

- b. If you were to place these three resistors in parallel, what would the equivalent resistance be? (Your answer should be between $0 - 100\ \Omega$)

$$\frac{1}{R_{eq}} = \frac{1}{100} + \frac{1}{140} + \frac{1}{80}$$

$$\boxed{R_{eq} = 33.73\ \Omega}$$

2. By how much is the resistance reduced if you change the circuitry of three $20\ \Omega$ resistors in series to three $20\ \Omega$ resistors in parallel? (Your answer should be between $40 - 60\ \Omega$)

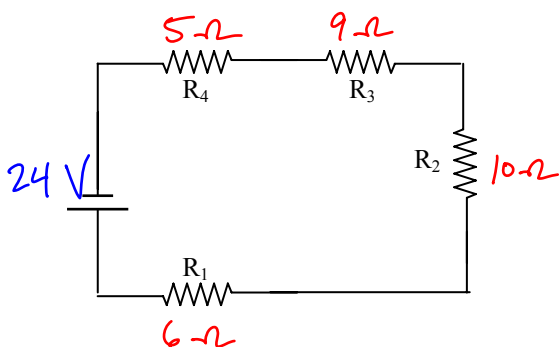
$$R_{eq, \text{series}} = \boxed{60\ \Omega}$$

$$\frac{1}{R_{eq, \text{parallel}}} = \frac{1}{20} + \frac{1}{20} + \frac{1}{20}$$

$$R_{eq, \text{parallel}} = \boxed{6.67\ \Omega}$$

$\rightarrow$ $\boxed{53.3\ \Omega}$

3. The circuit below has a $24\ \text{V}$ battery connected to resistors $R_1 = 6\ \Omega$, $R_2 = 10\ \Omega$, $R_3 = 9\ \Omega$, $R_4 = 5\ \Omega$. Calculate the equivalent resistance and the net current of the circuit. (Your answer should be between $20 - 35\ \Omega$, and between $0 - 1\ \text{A}$, respectively)

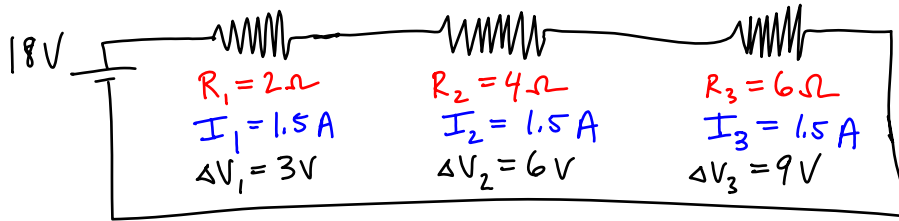


$$R_{eq} = R_1 + R_2 + R_3 + \dots + R_n$$

$$\boxed{R_{eq} = 30\ \Omega}$$

$$I_{net} = \frac{\Delta V_{tot}}{R_{eq}} = \boxed{.8\ \text{A}}$$

4. Three resistors are connected in series with an 18 V battery. $R_1 = 2\ \Omega$, $R_2 = 4\ \Omega$, $R_3 = 6\ \Omega$
 a. Draw a schematic diagram.



- b. Determine the equivalent resistance, and net current for the circuit. (Your answer should be between 10 – 20 Ω , and between 1 – 3 A respectfully)

$$R_{eq} = 2 + 4 + 6 = 12\ \Omega$$

$$I_{net} = \frac{\Delta V_{tot}}{R_{eq}} = \frac{18}{12} = 1.5\text{ A}$$

- c. Determine the current in each resistor, and the potential difference across each resistor. (Each resistor should have the same current, and the sum of the potential differences should equal the potential difference in the battery)

For Series

$$\Delta V_{tot} = \Delta V_1 + \Delta V_2 + \Delta V_3 \dots \Delta V_n$$

$$I_{net} = I_1 = I_2 = I_3$$

$$I_{net} = I_1 = I_2 = I_3 = 1.5\text{ A}$$

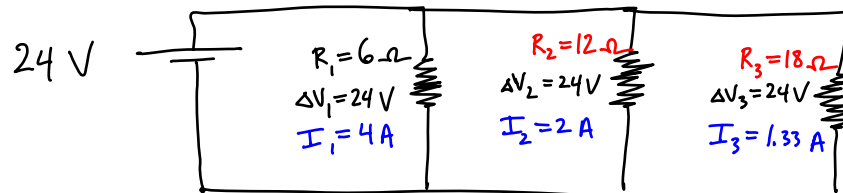
$$\Delta V_1 = I_1 \cdot R_1 = 1.5 \cdot 2 = 3\text{ V}$$

$$\Delta V_2 = I_2 \cdot R_2 = 1.5 \cdot 4 = 6\text{ V}$$

$$\Delta V_3 = I_3 \cdot R_3 = 1.5 \cdot 6 = 9\text{ V}$$

$$\Delta V_1 + \Delta V_2 + \Delta V_3 = 18\text{ V}$$

5. Three resistors are connected in parallel with a 24 V battery. $R_1 = 6.0\ \Omega$, $R_2 = 12.0\ \Omega$, $R_3 = 18.0\ \Omega$
 a. Draw a schematic diagram.



- b. Determine the equivalent resistance, and net current in the circuit. (Your answer should be between 0 – 10 Ω , and between 0 – 10 A respectfully)

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{6} + \frac{1}{12} + \frac{1}{18}$$

$$R_{eq} = \frac{36}{11} = 3.273\ \Omega$$

$$\Delta V = I_{net} R_{eq}$$

$$I_{net} = \frac{\Delta V_{tot}}{R_{eq}}$$

$$I_{net} = 7.33\text{ A}$$

- c. Determine the current in each resistor, and potential difference across each resistor. (The sum of the currents should equal the net current, and each resistor should have the same potential difference)

$$I_1 = \frac{\Delta V_1}{R_1} = \frac{24}{6} = 4\text{ A}$$

$$I_2 = \frac{\Delta V_2}{R_2} = \frac{24}{12} = 2\text{ A}$$

$$I_3 = \frac{\Delta V_3}{R_3} = \frac{24}{18} = 1.33\text{ A}$$

$$7.33\text{ A}$$

$$\Delta V_{tot} = \Delta V_1 = \Delta V_2 = \Delta V_3$$

$$I_{net} = I_1 + I_2 + I_3 \dots I_n$$

For Parallel

$$\Delta V_1 = 24\text{ V}$$

$$\Delta V_2 = 24\text{ V}$$

$$\Delta V_3 = 24\text{ V}$$