1 | Combining Resistors Method

The KBhPHYS201KirkoffsLaws Kirkoff's Laws themselves often requiring solving >6x6 matrixes to solve equations quickly. Which is hard.

1.1 | Series

If you have two resisters…

—||—||—

With the first having a resistance of $A\Omega$ and the second $B\Omega$.

The total resistance would simply be $(A+B)\Omega$.

- Same as equivalent of "electricity!" go through the first then the second

#disorganized

1.2 | Parallel

Smaller area |—||—— | Bigger area |===|||====

$R_2 = R_1 \times \frac{A_1}{A_2}$

$R_{eq} = R_1 \times \frac{A_1}{A_1+A_2}$

$\frac{1}{R_{eq}} = \frac{A_1+A_2}{A_1 R_1}$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{A_2}{A_1 R_1}$

$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R2}$

Resistance equation for series :pointup:

#disorganized

Calculate resistsance

1.3 | "Combine Resistors" Method

1.3.1 | Parallel Resistors as Single Resistors

Per the previous resisters rules, that $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R2}$, we could treat the 20Ω and 30Ω in parallel as a single resistor of 12Ω.

Now the circut becomes even simpler:

1.3.2 | Sequence Resistors as Single Resistors

Per the sequence resisters rules, that total resistance is $(A+B)\Omega$, we could combine these three resistors as a 37Ω resistor.

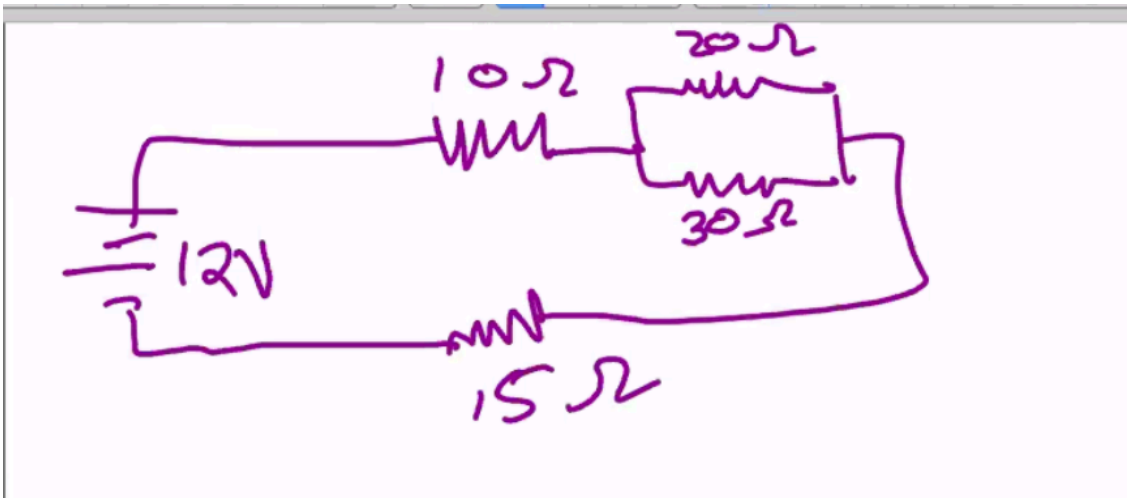

Figure 1: Screen Shot 2020-09-14 at 11.02.45 AM.png

Figure 2: Screen Shot 2020-09-14 at 11.05.49 AM.png

1.3.3 | Combined Current

We know that $12V/37\Omega = 0.324Amps$ is the current that returns to the battery and what the battery starts with, for if we treat the circuit as a single resistor, the 12 volts would only be working against.

From there, once we have a current for beginning and end, we could work our way up backwards by calculating the final voltage.

- Multiples battries can't be solved with the combined resistor method
- So, first guess the current flow
  - Each batteries' current will flow back to itself
  - When currents meet, they will combine
- Use currents identified before + Kirkoff's second law
- Use Kirkoff's first law to find loops (and hence equations) that, together, **covers all components**
- If resulting currents is negative, that means that you drew the current in the wrong direction, or you are charging a battery
  - Either way, if the signs are preserved to solve the rest of the equation, you should be fine numerically
  - Just update your graph to reflect the actual currents' directions

LED longer leg is positive