Resistance in Series and Parallel

Resistance in series:

In series by KVL,

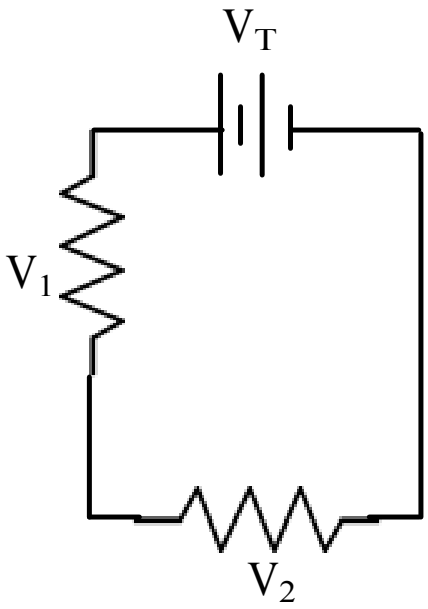
$V_T = V_1 + V_2$

From Ohm's Law $V_T = I_T R_T$

$I_T R_T = I_1 R_1 + I_2 R_2$

But in series $I_T = I_1 = I_2 = I_3$

So this cancels to

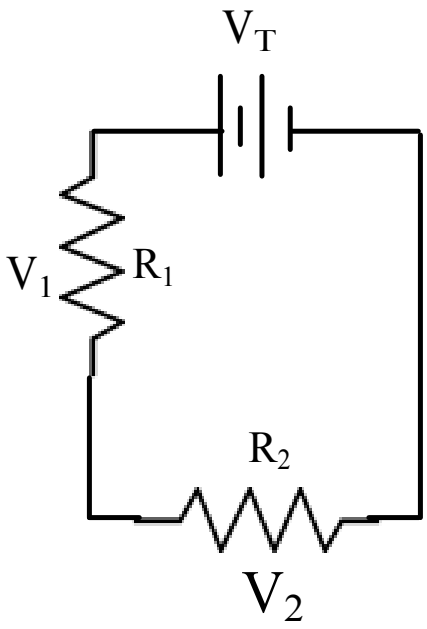


$$\mathbf{R_T = R_1 + R_2 + R_3}$$

Resistors in series add up algebraically.

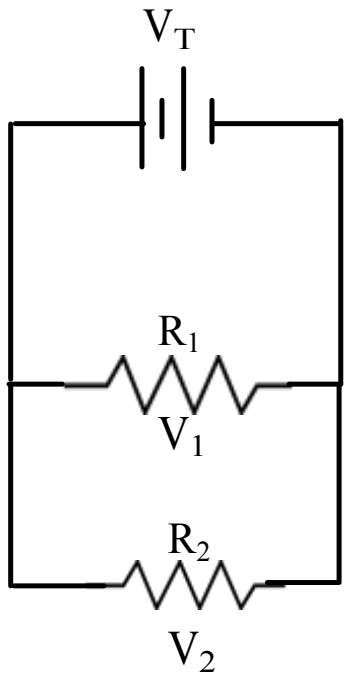
Draw the equivalent circuit.

Original Circuit...



Equivalent Circuit...

Resistance in parallel:



In parallel by KCL,

$I_T = I_1 + I_2 + I_3$

From Ohm's Law $V_T = I_T R_T$

$$\frac{V_T}{R_T} = \frac{V_1}{R_1} + \frac{V_2}{R_2}$$

But in parallel $V_T = V_1 = V_2$

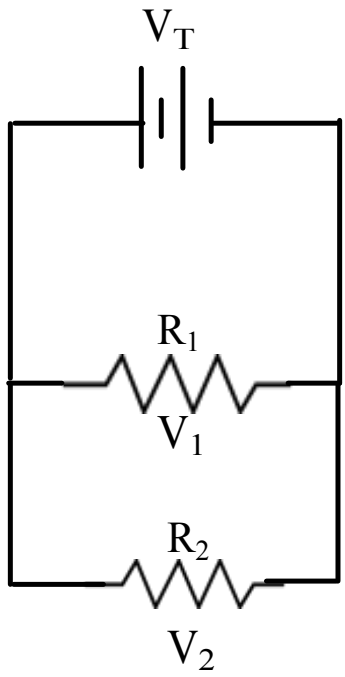
So this cancels to

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

Resistors in parallel are weird!

Draw the equivalent circuit.

Original Circuit...



Equivalent Circuit...