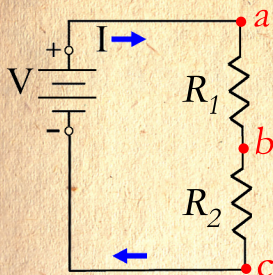




# IS FOR SERIES

Resistors are summed when in series. Batteries provide the sum of their voltages but the same number of amp-hours.



*$R_1$  and  $R_2$  are in series. A voltmeter may be connected at points a, b, and c.*

The equivalent resistance  $R_{eq}$  is equal to  $R_1 + R_2$ . Derivation:

There is only one current path, so the current must be the same at every point in the circuit, or there would be electrons piling up or disappearing. So  $I = I_1 = I_2$ .

The voltage across points a-c equals  $V$ . The voltage drop across a-b and b-c must then sum to  $V$ . So  $V = V_{a-b} + V_{b-c}$ .

By Ohms law, for the entire circuit  $V = I * R_{eq}$ , and within each resistor:

$$V_{a-b} = I_1 * R_1$$

$$V_{b-c} = I_2 * R_2$$

So by adding the equations and substituting the voltage:

$$V = I_1 * R_1 + I_2 * R_2$$

And as the current is the same in every part of the circuit,

$$V = I * R_1 + I * R_2 = I * (R_1 + R_2)$$

$$\text{And thus } R_{eq} = R_1 + R_2$$

The derivation for a battery is similar and left as an exercise.