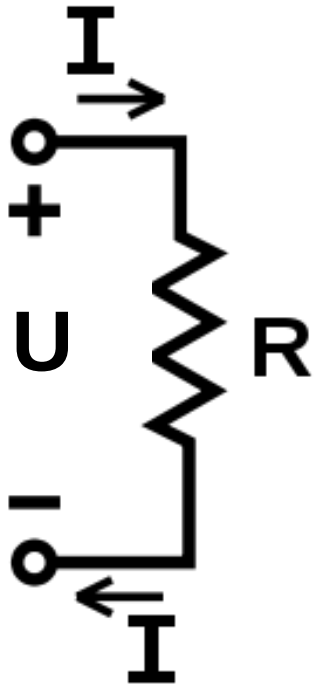
Ohm's Law

$$V = I \cdot R$$



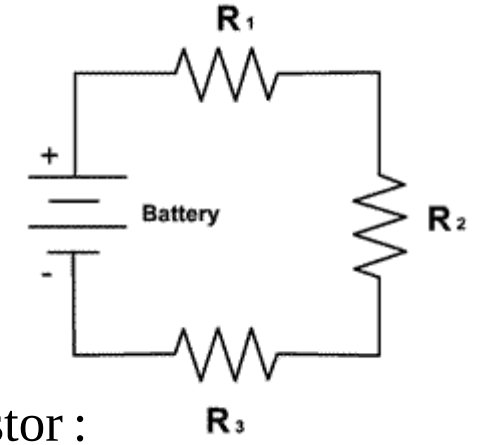
• **V** is **Voltage**, the **Potential Difference** between two ends of a wire (or resistor, light bulb etc). Measured in **Volts [V]**

• **I** is **Electric Current,** the total charge flowing through the wire in 1 sec. Measured in **Amperes [A]** (Coulomb per second) **:** **1A=1C/s**

• **R** is **Resistance** of the wire. Measured in **Ohms [Ω].** $1\Omega = 1\,V/A$

Serial connection:

Current the same. Voltage adds up.



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

$$U_{total} = U_1 + U_2 + U_3$$

the circuit can be replaced with an single resistor :

$$R = \frac{U_{total}}{I_{total}} = R_1 + R_2 + R_3$$

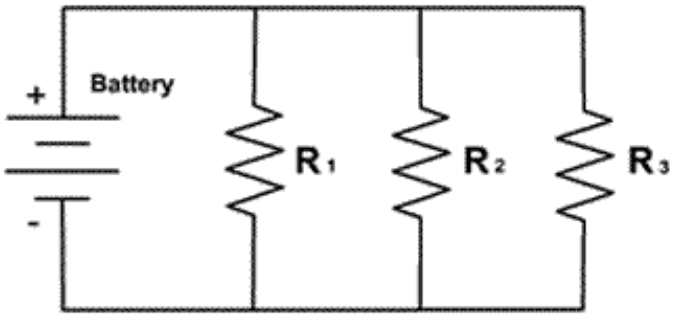
Parallel connection:

Voltage the same. Current adds up.

$$U_{total} = U_1 = U_2 = U_3$$

$$I_{total} = I_1 + I_2 + I_3$$

$$\frac{1}{R} = \frac{I_{total}}{U_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$



POWER

$$Power = \frac{Work}{time}, \qquad P = \frac{\Delta W}{\Delta t}$$

- **W** may be mechanical work, or work done by a battery driving an electric current.

- In this definition, ***Work*** can also be replaced with ***Heat***. That will be thermal power rather than mechanical or electric one.

- Units of power are Watts [W]: 1W=1J/s (Joule per second)

POWER IN ELECTRIC CIRCUIT

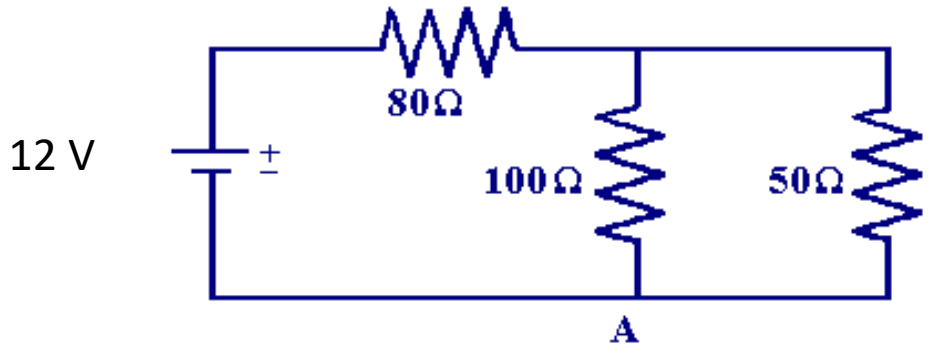
$$Power = Current \times Voltage, \qquad P = I \cdot V$$

Homework

Problem 1

a) Find the equivalent resistance and current in the circuit

b) You need to replace one of the resistors in the circuit above with a light bulb, so that the current through the bulb were the smallest possible. Which one will you replace?



Problem 2.

A light bulb has power P= 100 W when plugged into 110 Volt outlet. Assuming this bulb to have constant resistance, find the total power of three such light bulbs, when they are plugged into the same outlet

a) in parallel,

b) in series.