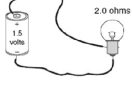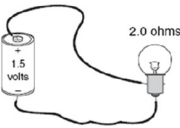# Series Circuits

Mr. Sudbury

Circuits

- A **circuit** is a complete path along which charge can *flow*.
- Must have a **voltage** (AKA potential difference) to *push the charge*.
- Circuits can have objects that resist flow of current.
- For charge to flow– circuit must be *closed*.
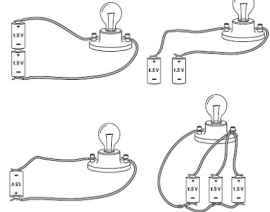- Ohm's Law is followed in circuits.

$$I = \frac{V}{R}$$

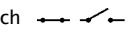- What is the current in this circuit?
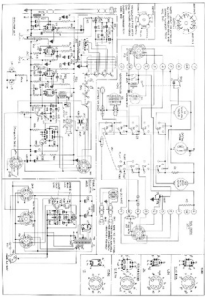
$$I = \frac{V}{R}$$

Circuit

- Will the bulb light?
  ◦ Circuits must provide a complete path for the charge to flow.

Schematic Diagrams

Use symbols to represent parts of a circuit.

Conductor (wire)

Cell

Batteries (2+ cells)

Light bulb

Open or closed switch

Misc. Resistor

Types of Circuits

Series Circuit
- Single pathway for electrons (charge) to flow between the terminals of the battery or wall socket
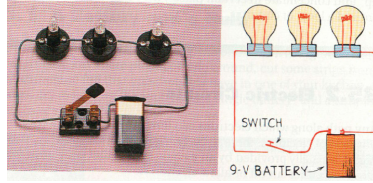
Parallel Circuit
- Multiple branches (or separate paths) for the flow of electrons (charge).

Series Circuit

- One path for current to travel.
- If 1 bulb burns out, *current cannot flow.*

SWITCH
9-V BATTERY

Series Circuit Rules

1. Single pathway for the current in the circuit. The current throughout the circuit is the constant.
2. Total resistance (R_T) is the sum of all the resistors. $R_T = R_1 + R_2 + R_3...$
3. Ohm's law: $I = \dfrac{V}{R}$
4. The Voltage is reduced as it goes through each device. Called Voltage drop. $V = IR$
5. Total voltage (V_T) in the circuit must equal the sum of all the voltage drops. (Voltage will be zero back at the battery.)

Solving Series Circuits

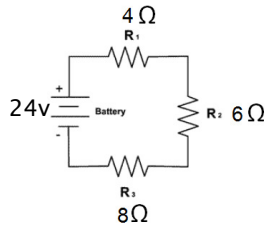## Resistance in Series Circuits

What is the R_T in the circuit?
- The resistance in a series circuit is the sum of all the resistors.
- $R_T = R_1 + R_2 + R_3 + ...$

- $R_T = 4\Omega + 6\Omega + 8\Omega =$

$4\,\Omega$ R_1
Battery
R_2 $6\,\Omega$
R_3 8Ω
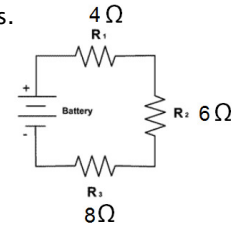
Series Circuits & Ohms Law

- Circuits follow Ohm's law:

- If the voltage is 24v, what is the current?

$I = \dfrac{V}{R}$
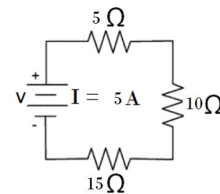

$4\,\Omega$ R_1
24v Battery
R_2 $6\,\Omega$
R_3 8Ω

Series Circuit
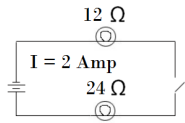
$I = \dfrac{V}{R}$ $V = IR$ $R = \dfrac{V}{I}$

- What is the R_T?

- What is the voltage drop @ each resistor?

- What is the V_T?

$5\,\Omega$
V $I = 5\,A$ 10Ω
$15\,\Omega$

Series Circuit
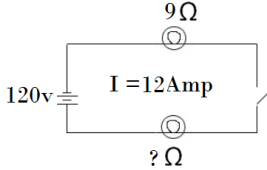
$$I = \frac{V}{R} \quad V = IR \quad R = \frac{V}{I}$$

▸ What is the R$_T$?

▸ What is the V$_T$?

12 Ω

I = 2 Amp
24 Ω

▸ What is the voltage drop @ each resistor?

Series Circuits

$$I = \frac{V}{R} \quad V = IR \quad R = \frac{V}{I}$$

▸ What is the R$_T$?

9Ω

▸ What is the resistance of the unknown resistor?

120v   I = 12Amp

? Ω

The End

▸ Series Circuits
  ◦ One path for current to flow.
  ◦ Voltage drops through each resistor and is 0 at the battery.
  ◦ Current travels throughout the circuit.
  ◦ Resistance is added to find total.

STOP