Types of Circuits

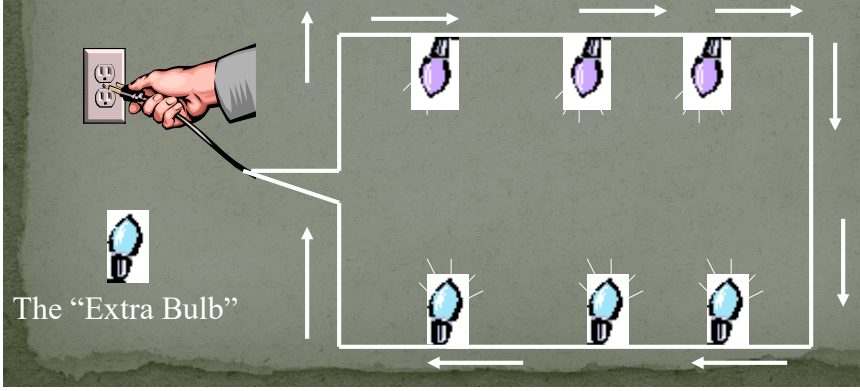
Series and Parallel Circuits

Mr. Duke

A Series Circuit

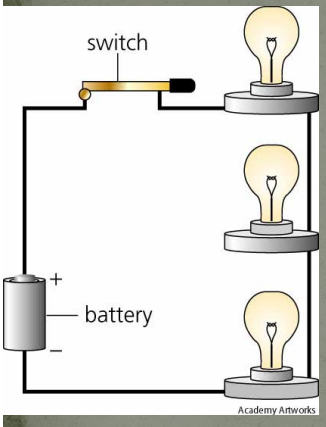
Only ONE pathway from negative to positive

If one light bulb burns out the rest will not work



The "Extra Bulb"

Current in a Series Circuit



Current only has 1 path to follow, so it must flow through each part of the circuit.

$$I_T = I_1 = I_2 = I_3 = \ldots$$

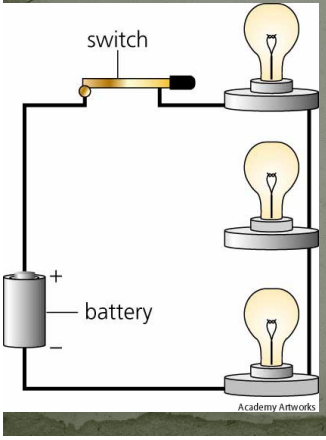
Charge can't be created or destroyed, so

current is constant throughout the circuit

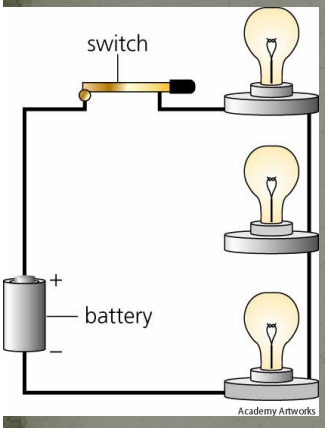
Resistance in a Series Circuit

Total Resistance = sum of individual resistances

$$R_T = R_1 + R_2 + R_3 + \ldots$$



Voltage in a Series Circuit



$$V_{total} = V_{drop}$$

Voltage drop = $V_T = V_1 + V_2 + V_3 + \ldots$

$V = I \times R$ Ohm's Law

Series Circuit Equations

$I =$ constant

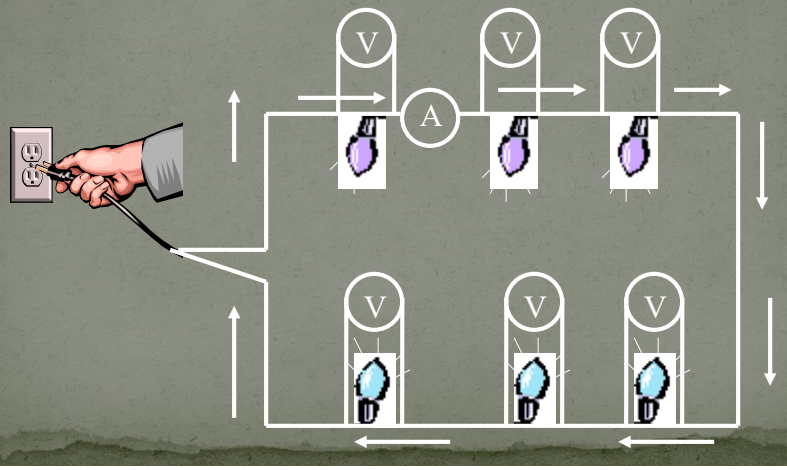
$R_{total} = R_1 + R_2 + R_3$

$V_{total} = V_1 + V_2 + V_3$

Voltmeters and Ammeters placement

Voltmeters are placed across the resistor

Ammeters are placed in series with the resistor



Example

Resistors in series TEKS 2C, 6E

1. A 12.0 V storage battery is connected to three resistors, 6.75 Ω, 15.3 Ω, and 21.6 Ω, respectively. The resistors are joined in series.
   a. Calculate the equivalent resistance.
   b. What is the current in the circuit?

Example

2. A 4.0 Ω resistor, an 8.0 Ω resistor, and a 12.0 Ω resistor are connected in series with a 24.0 V battery.

a. Calculate the equivalent resistance.

b. Calculate the current in the circuit.

c. What is the current in each resistor?

Example

4. A series combination of two resistors, 7.25 Ω and 4.03 Ω, is connected to a 9.00 V battery.

a. Calculate the equivalent resistance of the circuit and the current.

b. What is the potential difference across each resistor?

Example

5. A 7.0 Ω resistor is connected in series with another resistor and a 4.5 V battery. The current in the circuit is 0.60 A. Calculate the value of the unknown resistance.

Example

6. Several light bulbs are connected in series across a 115 V source of emf.

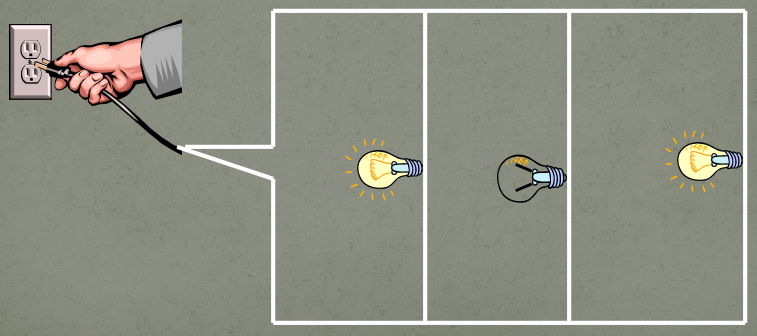
a. What is the equivalent resistance if the current in the circuit is 1.70 A?

b. If each light bulb has a resistance of 1.50 Ω, how many light bulbs are in the circuit?

A Parallel Circuit

More than ONE pathway from negative to positive

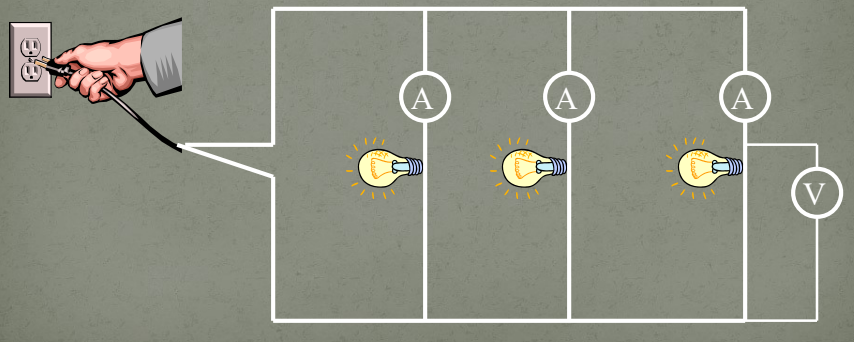
If one light bulb burns out it will not affect the rest



A Parallel Circuit

The voltage across each parallel branch is the same.

To measure the current you will need an Ammeter in each branch.



$V = I \times R$ Ohm's Law

Parallel Circuit Equations

$$I_T = I_1 + I_2 + I_3$$

$$1/R_{total} = 1/R_1 + 1/R_2 + 1/R_3$$

$$V_{total} = V_1 = V_2 = V_3$$

Example Problems done in class

2. A length of wire is cut into five equal pieces. The five pieces are then connected in parallel, with the resulting resistance being 2.00 Ω. What was the resistance of the original length of wire before it was cut up?

Example Problems done in class

3. A 4.0 Ω resistor, an 8.0 Ω resistor, and a 12.0 Ω resistor are connected in parallel across a 24.0 V battery.
   a. What is the equivalent resistance of the circuit?
   b. What is the current in each resistor?

Example Problems done in class

4. An 18.0 Ω, 9.00 Ω, and 6.00 Ω resistor are connected in parallel to an emf source. A current of 4.00 A is in the 9.00 Ω resistor.

a. Calculate the equivalent resistance of the circuit.
b. What is the potential difference across the source?
c. Calculate the current in the other resistors.