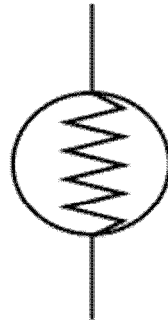


# Electric Circuits and Power

1. Wire – straight line

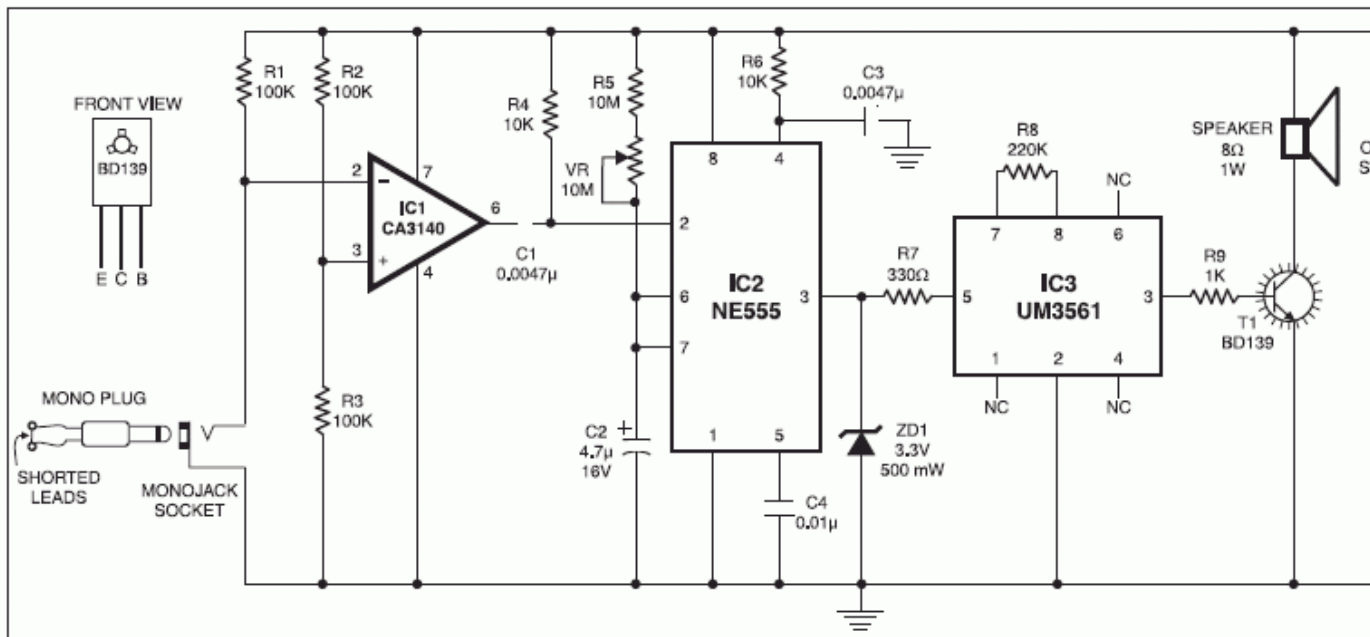
2. Battery 



Light Bulb

3. Bulb

4. Switch 

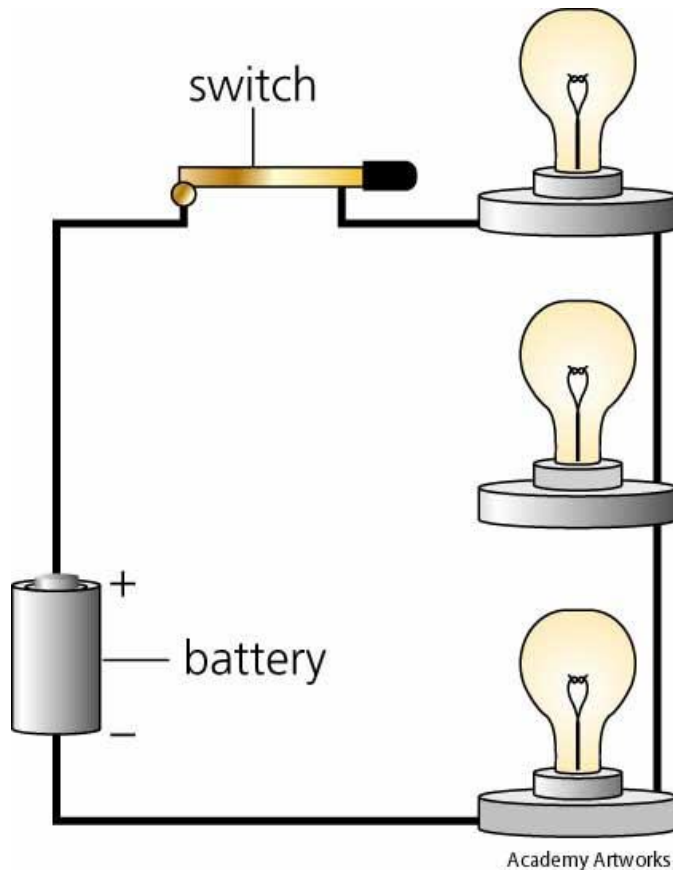


5. Resistance – is a measure of how easily electrical current moves through an object.
6. Voltage – is a measure of electrical potential energy; voltage differences represent energy that can be used to do work.
7. What is electric current?

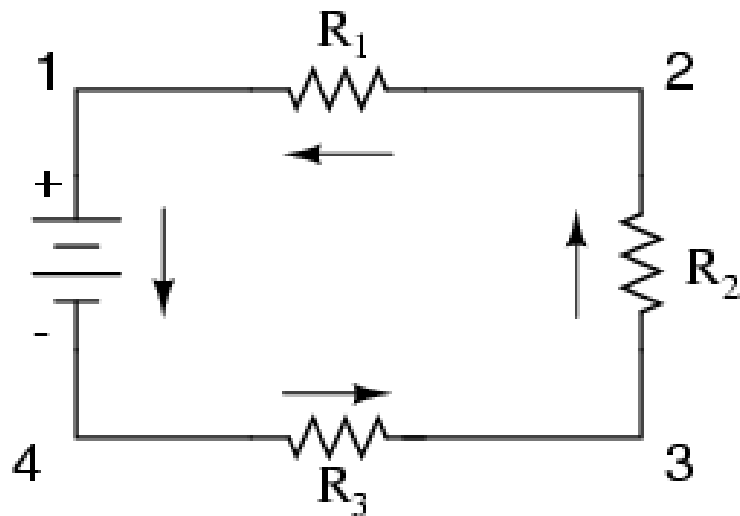
Carries electrical energy and power as it flows through metal wires; it is dependent on voltage and resistance

## I. Series and Parallel Circuits

- A. Series circuits contain only one path for current to flow.
- B. The amount of current is the same at all places along the circuit.
- C.



### *Series*



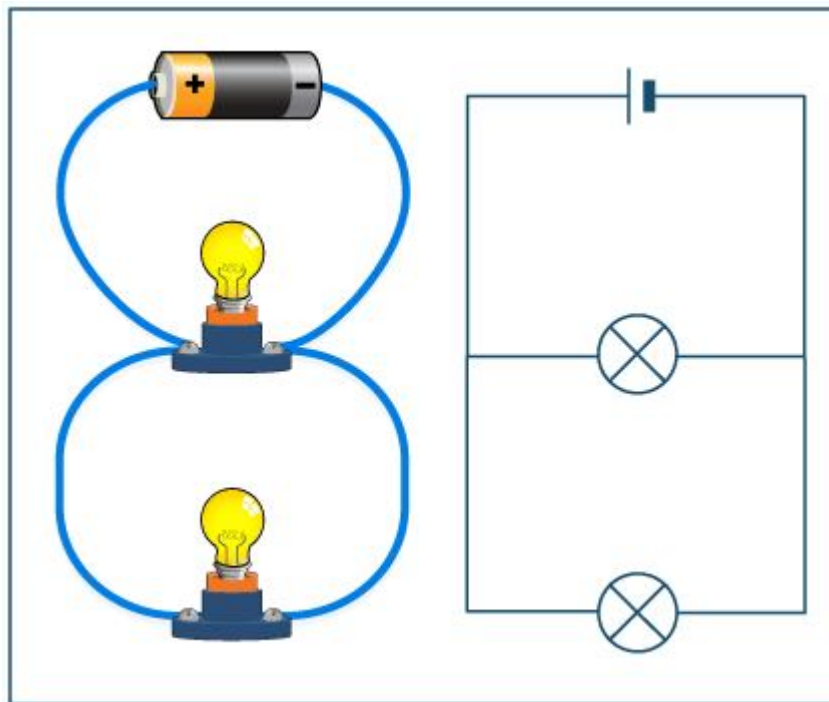
D. Total Resistance = Sum of individual resistances

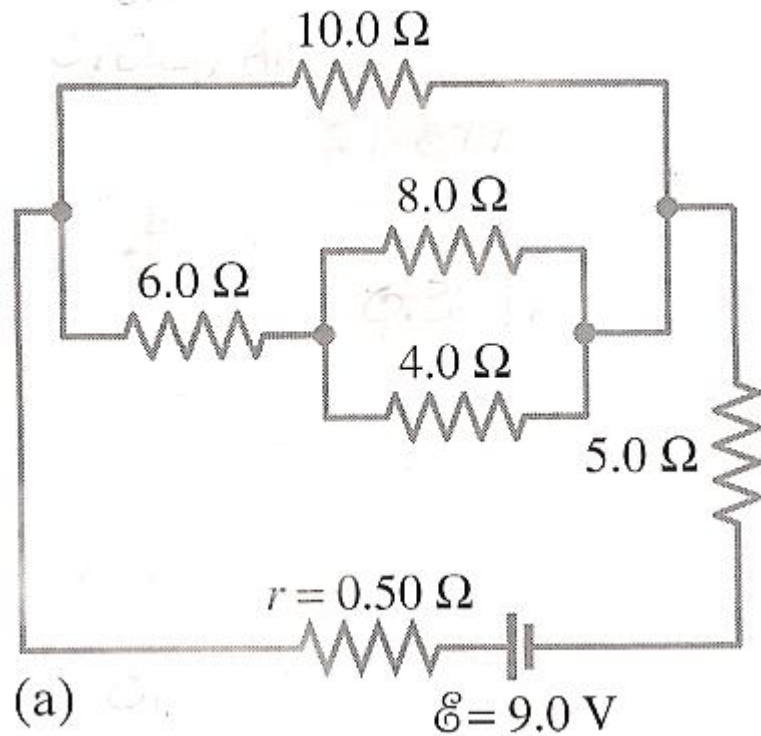
$$R_{\text{total}} = R_1 + R_2 + R_3 + \dots$$

- E. Every part of the circuit adds some resistance, even the wire and batteries.
- F. Voltage gets lower after each resistance. Therefore the total resistance in a circuit must consume all of the voltage.

## II. Parallel Circuits

- A. There are multiple paths for the current to flow through.
- B. All of the current flowing into a branch point in a circuit must flow out at some other point.
- C.





D. Due to the multiple branches, current is not the same at all points along the circuit.

E. Advantages:

1. each device will draw the same voltage
2. devices that break or are replaced in the circuit will not affect other devices

F.

$$\frac{1}{R_{total}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

### III. Three Circuit Laws

#### A. Ohm's Law

$$I = \frac{V}{R} \qquad \text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

B. Kirchhoff's current law – the total current flowing into any junction in a circuit equals the total current flowing out of the junction.

C. Kirchhoff's voltage law – total of all voltage gains and drops around a circuit must equal 0.

### IV. Problems

A. What is the voltage of a 0.25 amp current that has a resistance of 12.0 ohms?

$$0.25 = \frac{\text{Voltage}}{12.0}$$

$$(0.25)(12.0) = \text{Voltage}$$

$$\text{Voltage} = 3.0V$$

B. Determine the resistance in a 3.0 A circuit that is driven by 15.0 volts.

$$3.0 = \frac{15.0}{\text{Resistance}}$$

$$(3.0)(\text{Resistance}) = 15.0$$

$$\text{Resistance} = 5.0\Omega$$

## V. Electric Power, AC, and DC Electricity

- A. Electric power is the product of the voltage and current in a circuit.

$$P = VI$$

- B. Watts (W) are the unit of power. One watt is small, so generally a kilowatt or megawatt is used.
- C. Horsepower is not used as much anymore. 1 hp = 746 W.
- D. The power is the same in a 200 V/5 amp circuit or a 1000 V/1 amp circuit. Amperages are generally very low, so voltage and power are usually large.

- E. Direct current (DC) flows in one direction only. Batteries operate this way.
  
- F. Alternating current (AC) is current that flows in both directions. It is easy to generate and transmit over large distances, so it is used for high-power applications.