RESISTANCE

Aakanksha Bajpai
Assistant Professor
School of Health Sciences

- Resistance is the opposition to the flow of current in a conductor.
- Resistance is measured in ohm's (Ω) symbolized by the Greek letter.
- George Simon ohm is a German physicist who studied the relationship between voltage, current and resistance.

Factors on which resistance depends

- **Length of the conductor-** The resistance of the conductor is directly proportional to its length. Therefore, a long wire will have a greater resistance than a short wire.

- **Area of cross-section-** Resistance of a conducting wire varies inversely to the area of cross-section. Thus, a thin wire will have higher resistance than a thick wire.

- **Material of conductor-** Resistance depends on the material of the conductor because the number of free electrons in a unit volume is different for different materials.

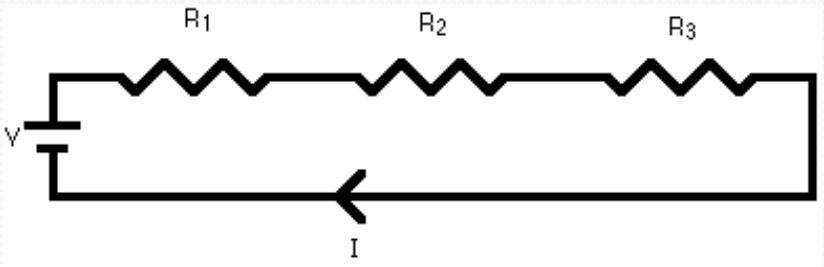
- **Temperature-** As the temperature of a conductor increases so does the kinetic movement of the molecules. This increased movement impedes the passage of electrons and so increases the resistance.

- **Resistor-** A resistor is an electronic device that offers the obstruction to the flow of electric current. It can be defined as the voltage per unit current through a conductor.

- **Rheostat-** It is a variable resistor, which is used to control current. It can vary the resistance in a circuit without interruption. Rheostats are used as power control devices for example, to control light intensity, to adjust generator features, control speed of motors and heaters.

Combination of Resistance

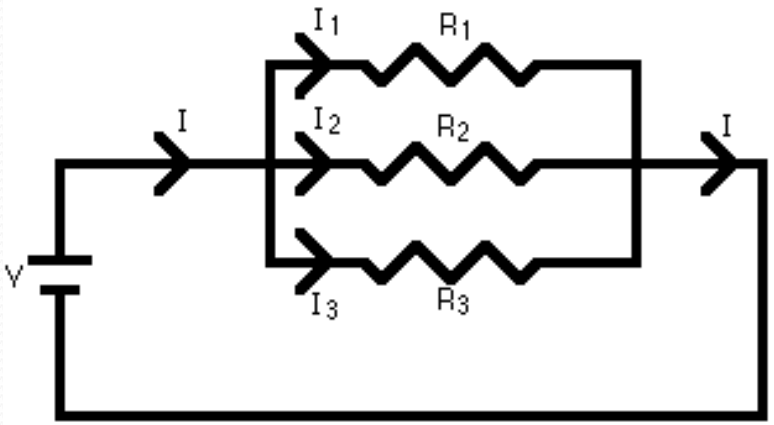
Resistance in series-When the components of an electric circuit are linked in series, there is only one channel for current to travel. The overall resistance equals the sum of the individual resistances since the current must flow through each resistance in turn. The overall resistance between the terminals in such a connection is the sum of the individual resistances**.**



Resistors in series

$R_{total} = R_1 + R_2 + R_{3....} + R_n$

Resistance in Parallel- Resistances are said to be wired in parallel if different current flow through them and get added afterwards. Consider a number of resistances R1, R2 and R3 connected parallel to each other. A current I is divided into three parts and flow through each of these resistances.



R1 in Parallel with R2, R3, and So On

$$\frac{1}{R_{Total}} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \ldots + \frac{1}{Rn}$$

OHM'S LAW

- A German scientist, George Simon ohm in the year 1828 was able to demonstrate that the current flowing in a circuit is directly proportional to the potential difference across it. He formed a law on the basis of his relation which is known as ohm's law.

- The law states that the current flowing through a metallic conductor is directly proportional to the potential difference.

- Potential difference applied across its ends are inversely proportional to the resistance of the conductor, provided that all physical conditions remain constant.

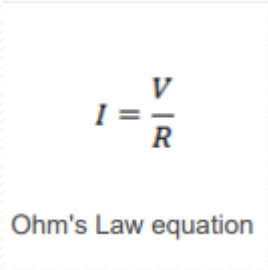
$$I \propto V$$

I=KV (K= Conductance)

K=1/R

I=V/R

V=IR



I- current

V-voltage

R- resistance

Ohm's law is explained by the following statement.

- **Current varies directly with applied voltage**

A change in the voltage applied to a circuit will cause the current flowing in the circuit to change. If the resistance is constant, the current change will follow the pattern of the voltage change. Doubling the potential difference doubles the current.

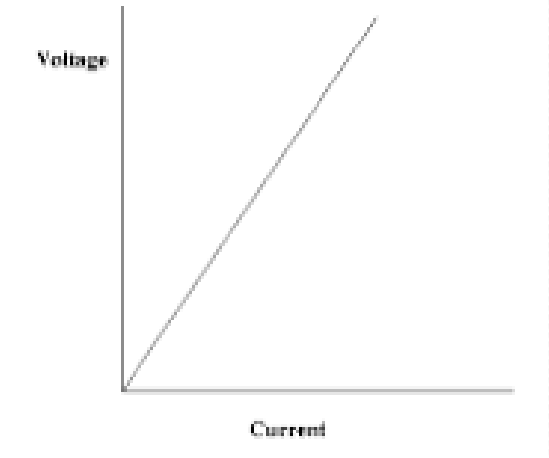
Current varies inversely with resistance

Changing the resistance in a circuit will also cause a change in current flow. if the voltage applied to a circuit is held constant, and the resistance in the circuit is increased. With more opposition to current flow in the circuit, the circuit current will decrease. On the other hand, if the resistance is decreased the amount of current flow in the circuit will be increased.

❑ Voltage vs. current

The relationship between voltage and current can be graphically represented with this illustration. thus:

1. the higher the voltage, the larger the current
2. the higher the resistance the lower the current



Limitations of Ohm's Law-

- Temperature of the conductor should remain constant.
- The conducting body should not be deformed.
- It takes place in metallic conductors only.

REFERENCES

- Textbook of Electrotherapy.Jagmohan Singh
- Essentials of Electrotherapy. Purusotham Chippala

THANK YOU