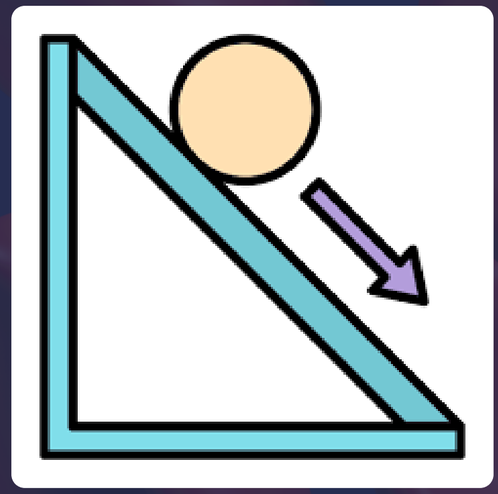
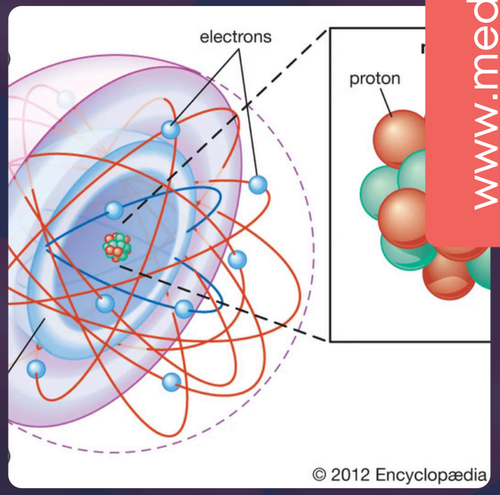
FSC-MIT-1

LEC#8 (11/11/2024)

FIRST-YEAR PHYSICS
FOR RADIOGRAPHERS





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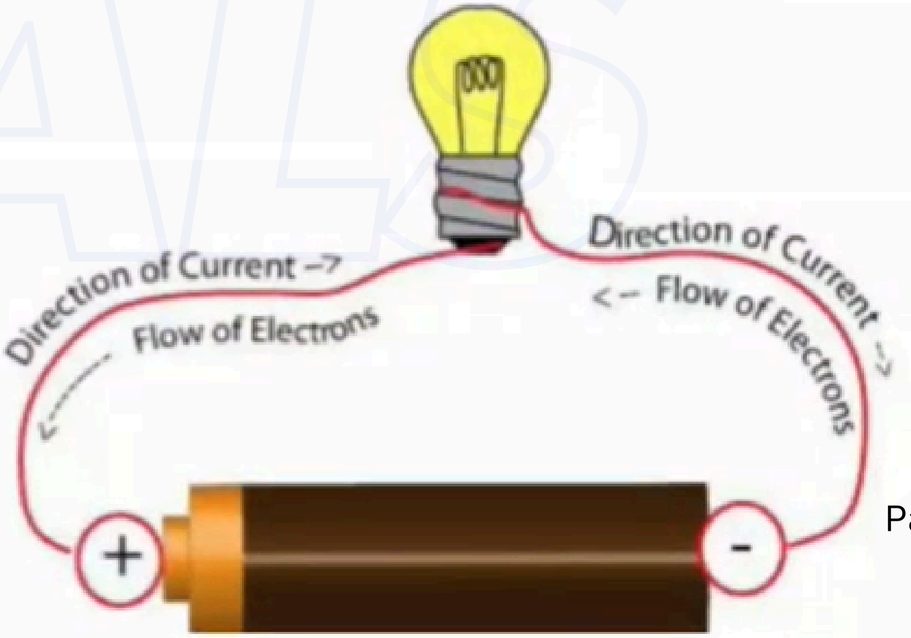
CHAPTER# 4

ELECTRICITY
CURRENT
OHM LAW

H/ DR. AYESHA RAUF

What is Electricity ?

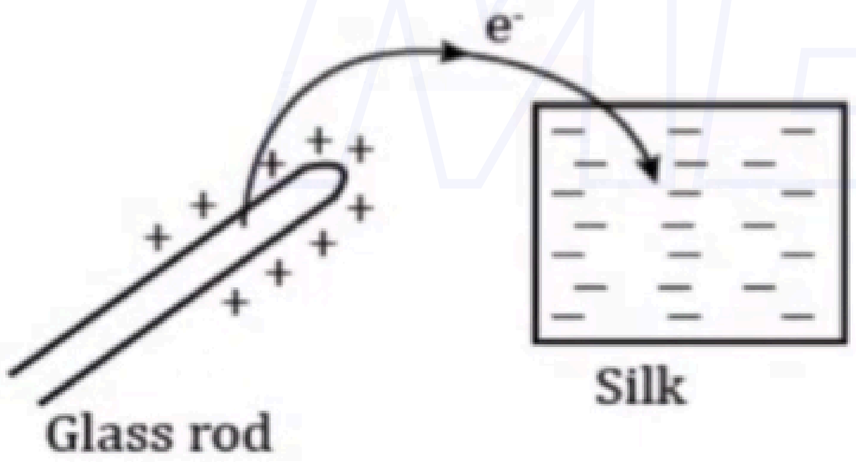
- The set of physical phenomena related to the presence and flow of electric charges that produce potential and kinetic energy is called electricity .
- Electric Charge are two type :- Positive charge (Proton) & Negative charge (electron).
- Electrons are the basis of all electricity , Because electrons are light and can move easily
- There are static electric charges have Potential energy And Moving electric charges have kinetic energy.

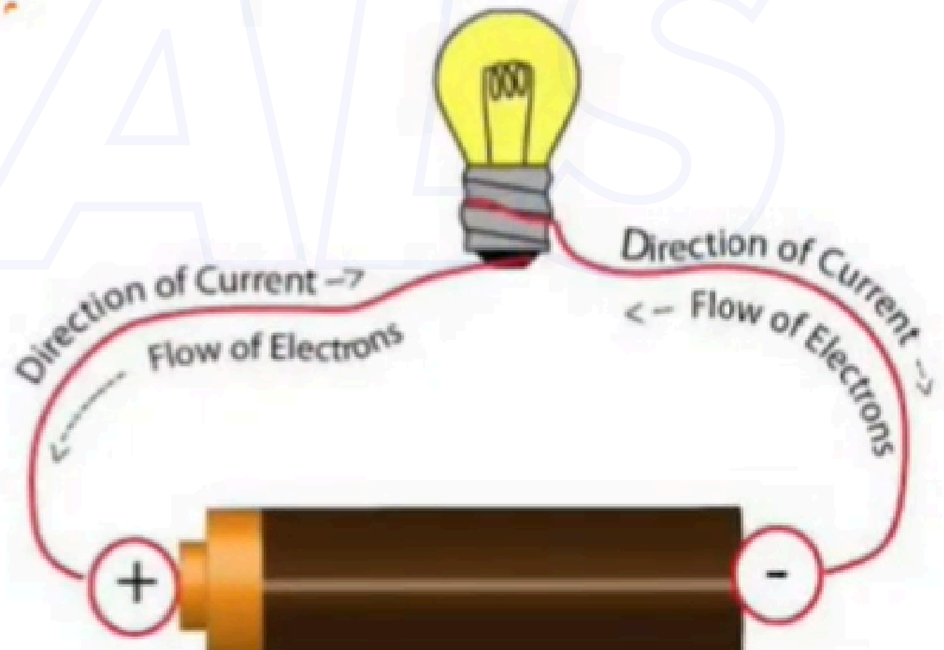


There are two main types of electricity :-

1. Static Electricity :- Produced by the rest electric charges that can be generated by rubbing two or more objects like glass rod rubbing to the silk cloth.

2. Current Electricity ;- flow of electric charge through a conductor in a direction.



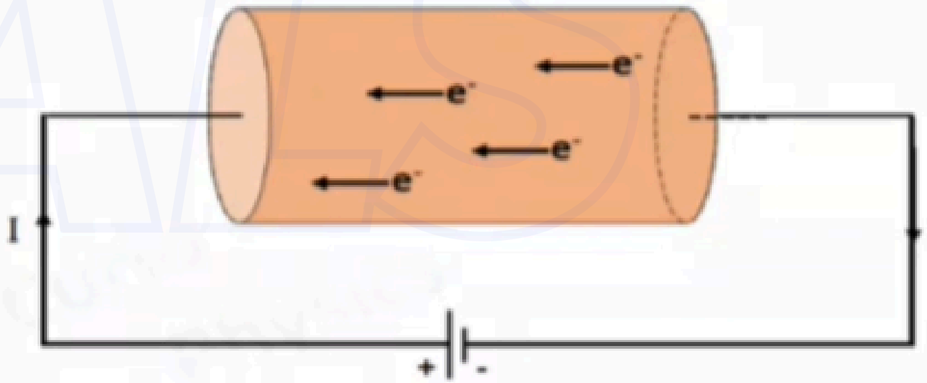


Two "Types" of Electricity

- **Static Electricity**
  - Electrons *do not flow* in predictable patterns.
  - Charges build up and "jump".
  - Has limited uses to power modern technology.
  - Responsible for Lightning and "static cling"
- **Current Electricity**
  - Electrons flow through wires in predictable patterns.
  - Can be easily harnessed to do work and power modern technology.
  - Responsible for most of the things in your life.

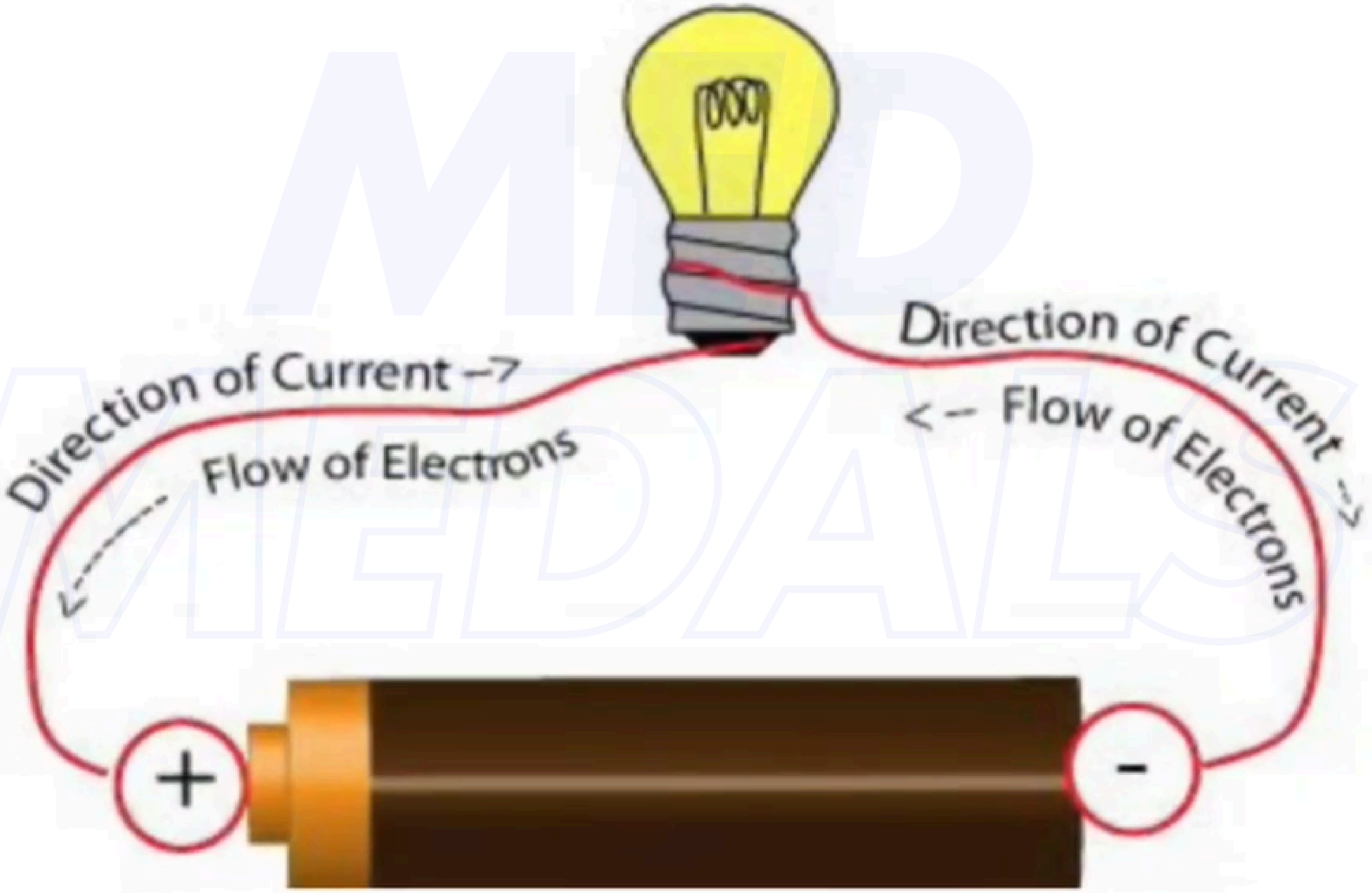
What is Electric Current ?

- In certain substances, electron can move freely through the material.
- Therefore, electric charge is transferred from one point to anotherin the substances, this movement of electric charge in a conductor is called an electric current.
- It is equal to the quantityof charge passing at a given point in one second.
- It is a scalar quantity.



- Unit = Ampere (A)
- Sub units = mA(10^{-3}A) and μA(10^{-6}A).
- One Ampere current :- one coulomb charge flow through a wire in one second.

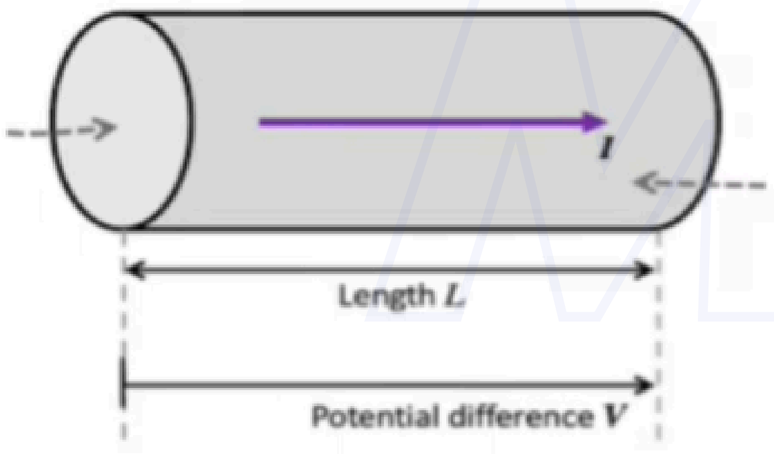
Direction of current



What is Ohms Law ?

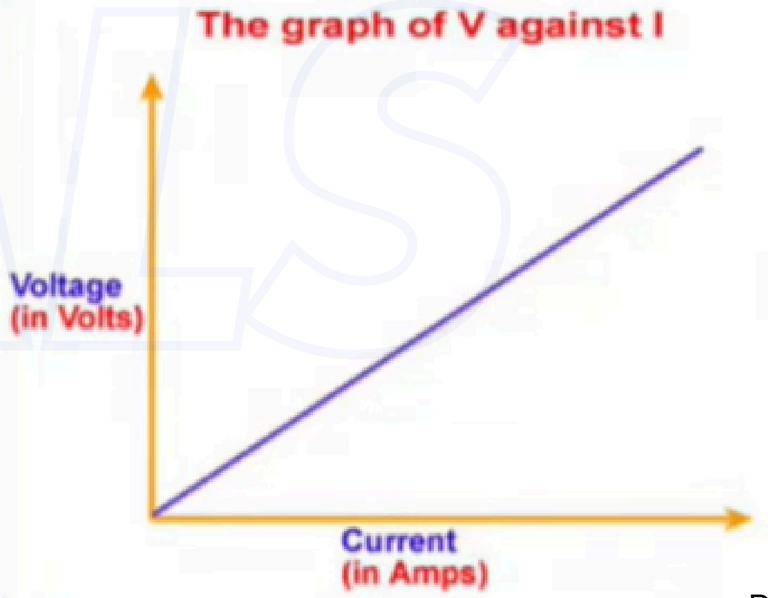
- Ohms law states ; if all physical conditions remaining constant (like - T, P and humidity) then,

The potential difference across the ends of a conductor is directly proportional to the current flow through the conductor.



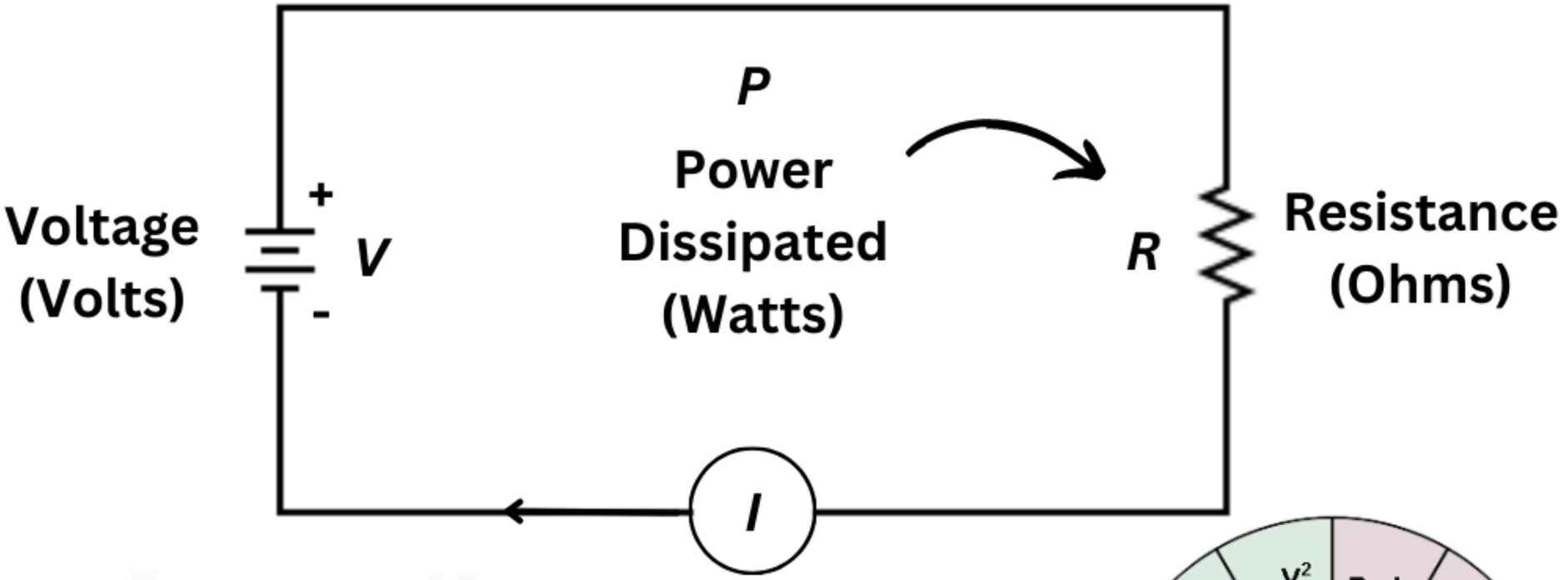
$$I \propto V$$

$$V = IR$$



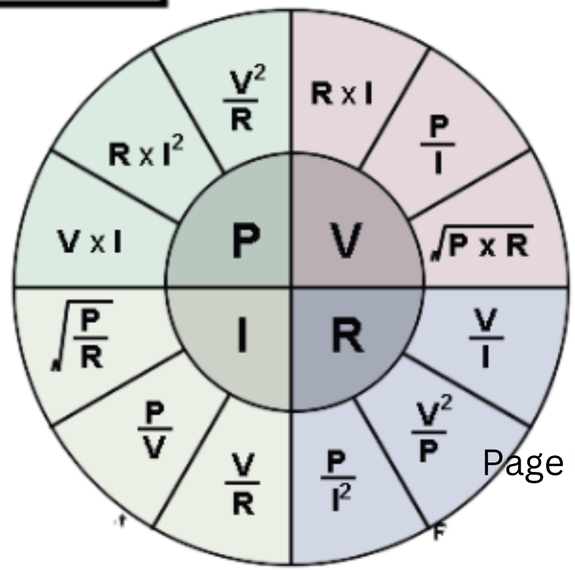
R = Resistance of conductor (Constant for ohimic conductor).

Ohm's Law

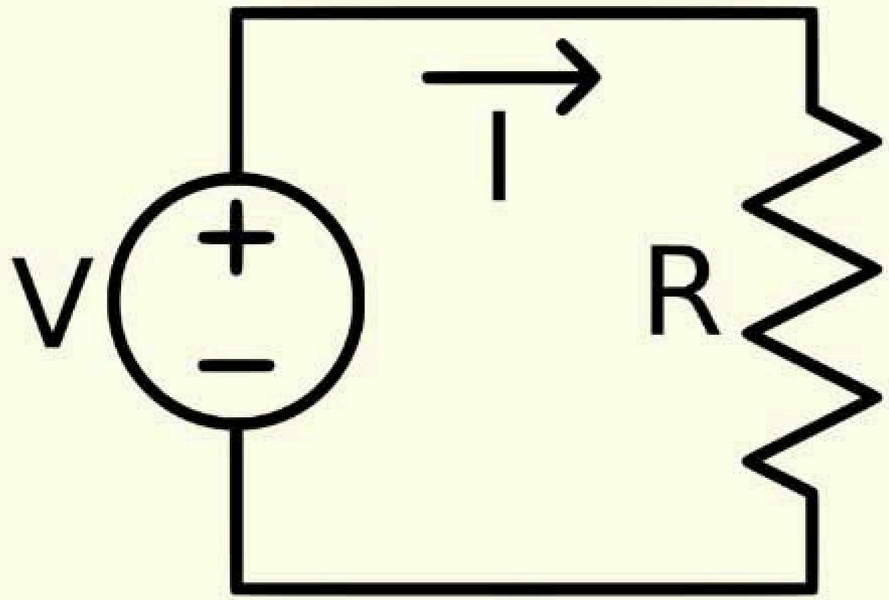


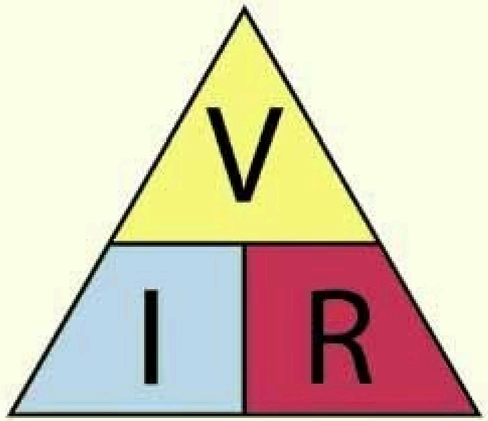
$$V = I \times R \qquad I = \frac{V}{R} \qquad R = \frac{V}{I}$$

$$P = VI = \frac{V^2}{R} = I^2 R$$



Ohm's Law





V=I x R

Resistance (R) :-

- Resistance is the property of a conductor by which it opposes the flow of current.

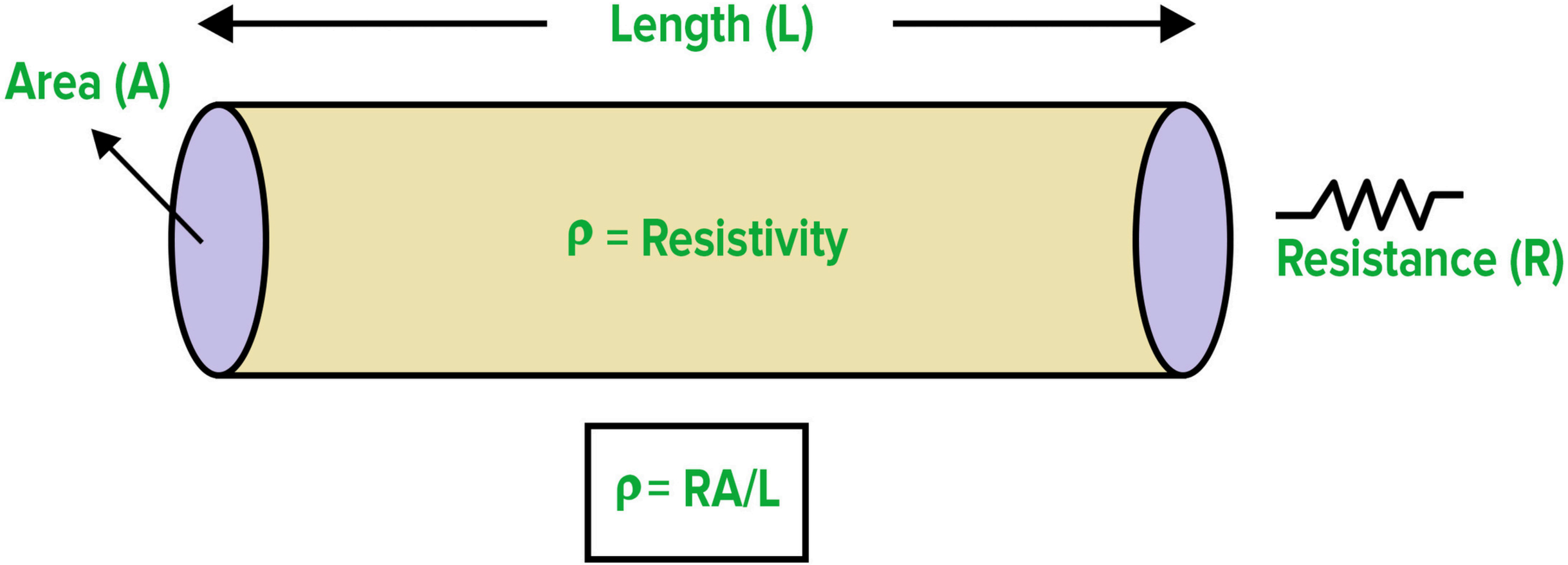
$$R = \frac{V}{I}$$

Unit :- ohm (Ω).

- The device, which offers resistance totheflow of current is called resistor.

The resistance of a material is influenced by:-

1. Shape of material
2. Type of material
3. Temperature of material


Length (L)
Area (A)
ρ = Resistivity
Resistance (R)
ρ = RA/L

Specific Resistance (ρ):-

- The resistance of a resistor at a given temperature depends upon the material and its dimensions.
- The resistance (R) is directly proportional to the length (L) and inversely proportional to the area of cross-section (A) of resistor.

$$R \propto \frac{L}{A}$$

$$\text{Or} \quad R = constant \times \frac{L}{A}$$

Here, ρ is constant , called the specific Resistance.

$$\text{Or} \quad R = \rho \times \frac{L}{A}$$

- Unit :- ohm-meter

$$\text{Or} \quad \rho = \frac{RA}{L}$$

Here ρ is a constant.

- Reciprocal of specific resistance (1/ρ) is called Conductivity (σ).

Resistance	Specific resistance
1. It is the ratio of the P.D. across the two ends of a conductor to the current flowing *i.e.* $R = \frac{V}{I}$	1. It is the resistance of conductor of unit length and unit area of cross-section and is given by $\rho = \frac{RA}{l}$.
2. It depends upon the length, area of cross section and nature of material.	2. It is independent of length and area of cross section of the material and depends only on the nature of the material.
3. Unit of resistance in SI is ohm (Ω).	3. Unit of specific resistance in SI is ohm-metre (Ω m).