Electric Current: The electric current is the rate of flow of electric charges (called electrons) in a conductor.

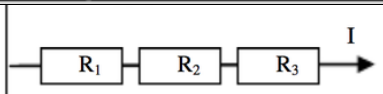
If a charge of Q coulombs flows through a conductor in time t seconds, then the magnitude I of the electric current flowing through it is given by Current, **I = Q/t** The SI unit of electric current is **ampere** and it is denoted by the letter A. Electric current is a **scalar quantity**.

Practical Electricity	
Electric Power $P = VI = V^2/R = I^2R$	P = Power V = voltage R = resistance I = current
Electrical Energy $E = Pt = (VI)t$	E = energy output P = power t = time V = voltage I = current

Current of Electricity	
Current $I = Q / \Delta t$	Current = rate of flow of charges Q = Charge t=time
Ohm's Law **Resistance** $R = V / I$	V = voltage, R = resistance I = current
Resistance of a wire $R = \rho L/A$	ρ = resistivity L = length of wire A = cross sectional area

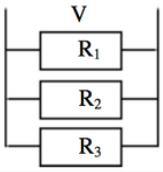
Resistance in Series

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



Resistance in Parallel

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

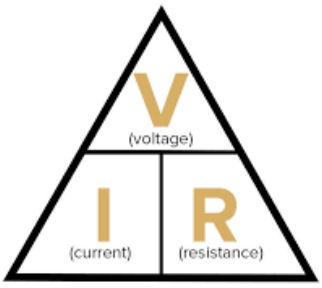


IF Resistors have same value and connected in

a. Parallel : Rp = R/n
b. Series : Rs = R*n

1. Charge q on a body is always denoted by q= ne
   where n = any integer positive or negative and $e=1.602\times10^{-19C}$. e., charge on an electron or proton.
2. Work done=charge ×potential
   Mathematically, W=Qv
3. Electric Current=charge/time
   Or,
   I=q/t Unit :Ampere
4. **Electrical Power**
   $P=VI=I^2R=V^2/R$
5. **Joules Law of Heating : $H = I^2Rt$**

Ohm's law:



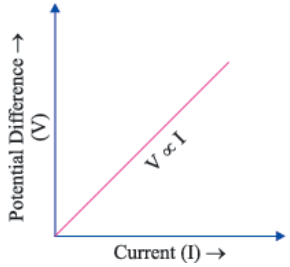
If the physical condition remains same, the current flowing through a conductor is directly proportional to the applied potential difference between the two ends of the conductor and vice a versa. For the current I flowing through a conductor having potential difference V across its ends, we have:

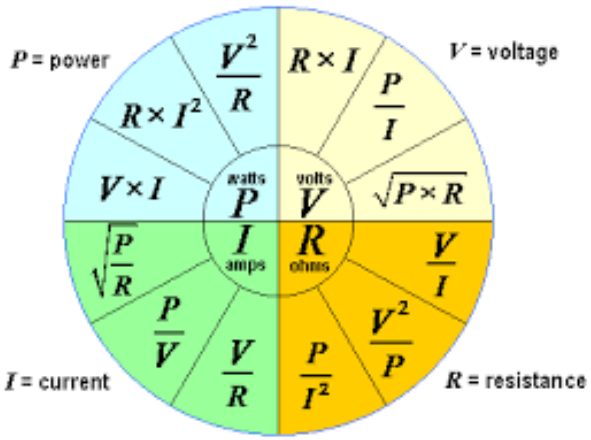
- Mathematical expression for Ohm's law :

  $V \propto I$

  $V = IR$

  R is a constant called resistance for a given metal.
- V-I graph for Ohm's law :





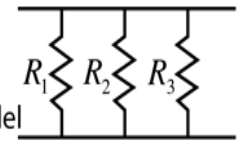
Series

$$R_{equivalent} = R_1 + R_2 + R_3 + \ldots$$

$$R_{equivalent} = \frac{V}{I} = \frac{V_1 + V_2 + V_3 + \ldots}{I} = \frac{V_1}{I_1} + \frac{V_2}{I_2} + \frac{V_3}{I_3} + \ldots = R_1 + R_2 + R_3 + \ldots$$

Series key idea: The current is the same in each resistor by the current law.

Parallel

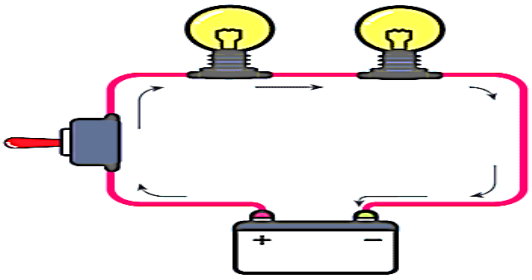


$$\frac{1}{R_{equivalent}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

Parallel: $$\frac{V}{R_{equivalent}} = I = I_1 + I_2 + I_3 + \ldots = \frac{V_1}{R_1} + \frac{V_2}{R_2} + \frac{V_3}{R_3} + \ldots$$

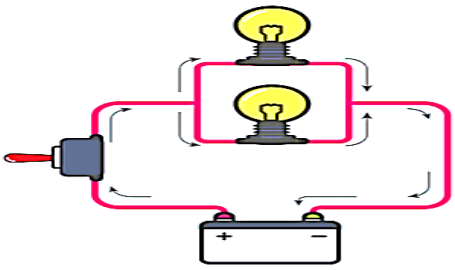
$$\frac{1}{R_{equivalent}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots$$

Parallel key idea: The voltage is the same across each resistor by the voltage law.



SERIES CIRCUITS

A series circuit is made by connecting the end of one device to the beginning of another.



PARALLEL CIRCUITS

In parallel circuits, the same terminals of both devices are connected together.

Advantages of Parallel Combination over Series Combination

(i) In series circuit, when one component fails, the circuit is broken and none of the component works.
(ii) Different appliances have different requirement of current. This cannot be satisfied in series as current remains same.
(iii) The total resistance in a parallel circuit is decreased.

Factors affecting the Resistance of a Conductor: The resistance of the conductor depends:
(i) on its length, (ii) on its area of cross-section (iii) on the nature of its material.

Heating Effect of Electric Circuit

If an electric circuit is purely resistive, the source of energy continually get dissipated entirely in form of heat. This is known as heating effect of electric current.

As $E = P \times T \Rightarrow t\ VI$ $\{E = H\}$
Heat produced, $H = VIt$ $\{V = IR\}$
Or Heat produced, $H = I^2Rt$

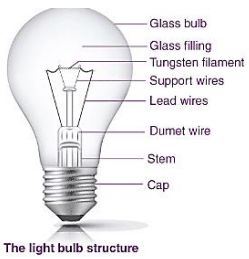
Commercial Unit of Electrical Energy: Kilowatt hour .

One kilowatt hour is the electrical energy consumed when an electrical appliance having 1kW power rating is used for 1 hour.
Energy used = Power x Time 1 kWh = 1 kW x lh = 1000 w x 60 x 60s = 1000 Js^{-1} X 3600 s = 3600000 J= **3.6 x 106 J**

Filament of electric bulb is made up of tungsten as
(i) it does not oxidize readily at high temperature.
(ii) it has high melting point (3380° C).
The bulbs are filled with chemically INACTIVE gases like nitrogen and argon to prolong the life of filament.

Electric Fuse: It is a safety device that protects our electrical appliances in case of short circuit or overloading.

- ☞ Fuse is made up of pure tin or alloy of copper and tin.
- ☞ Fuse is always connected in series with live wire.
- ☞ Fuse has low melting point and Higher resistivity.
- ☞ Current capacity of fuse is slightly higher than that of the appliance.



The light bulb structure