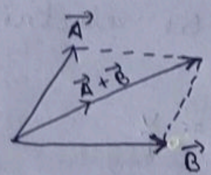
CURRENT ELECTRICITY

Uses - i) Automobile
ii) Household

Scalar → Do not have direction
Vector → Direction and magnitude



current - Flow of charge

$\vec{A}$ → vector law of addition

current does not obey vector law of addition
Current is not a vector. It is tensor.

Charge → Constant velocity → Electricity
Charge → Accelerated motion → Electromagnetic

Electric current :- It is defined as rate of flow of charge

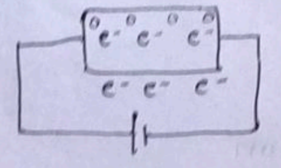
$$i = \frac{\Delta q}{\Delta t}$$

For infinitional charge $i = \frac{dq}{dt} = \frac{\text{coloumb}}{\text{sec}}$

$$\text{Ampere} = \frac{\text{Coloumb}}{\text{sec}}$$

When one coloumb charge is flows through a circuit in 1 sec, the amount of current is said to be one ampere.
Though current has direction and magnitude. It is not considered as a vector because it doesn't obey vector law addition.

Resistance (Ω)



abstruct current

The property of resistance is to obstruct the flow of electric current it is said to be electrical resist-ance.

Unit → ohm Resistance, $R = \frac{V}{I}$

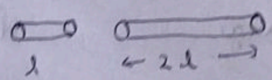
For any conductor of length 'l' and area 'A', the resistance is given by $R = \rho \frac{l}{A}$

$\rho \rightarrow$ Resistivity

$\rho = \frac{m}{ne^2\tau}$ = Resistivity.

Ques A wire of length (l) has resistance R this wire is stretched to twice the original length, find the new resistance.

Sol^n $\boxed{R = \rho \frac{l}{A}}$ $\boxed{R \propto l \quad R \propto \frac{1}{A}}$



$R' = \rho \frac{l'}{A'}$

$= \rho \frac{2l}{A'}$

$= \rho \frac{2l}{A/2}$

$= 4\rho \frac{l}{A}$

$= 4R$

$V_i = V_f$

$\Rightarrow A \times l = A' \times l'$

$\Rightarrow Al = A' \times 2l$

$\Rightarrow \boxed{A' = \frac{A}{2}}$

Current density ~~Scalar quantity because it does have~~

$$J = \frac{i}{A}$$

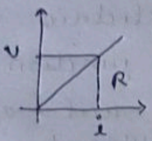
current passing through unit area of the conductor

Ohm's law

$V \propto i$

$V = R i$

$y = m x$



All ~~phy~~ ~~of~~ physical condition remaining same, the potential difference across the end of the conductor is ~~the~~ ~~dro~~ directly proportional to the current flowing through the conductor. If V is the proportional difference and i is the current flowing through the conductor and $V \propto i$ and $\boxed{V = IR}$

Ques A wire of length, $l = 20\,cm$, $A = 200\,cm^2$, if a potential difference $V = 10\,V$ is applied then how much current will following through it

(Given $\rho = 1.72 \times 10^{-8}$ ohm m)

Soln we know

$$R = \rho \frac{l}{A}$$

$$\Rightarrow R = \frac{1.72 \times 10^{-8} \times 20 \times 10^{-2}}{200 \times 10^{-4}}$$

$$\boxed{R = 1.72 \times 10^{-7}}$$

$\therefore$ using ohm's law

$V = I R$

$\Rightarrow I = \frac{V}{R} = \frac{10}{1.72 \times 10^{-7}}$ $\Rightarrow I = 0.58 \times 10^{8}$

$\Rightarrow \boxed{I = 5.8 \times 10^{7}\,A}$

Kirchaff's law

(i) KCL

(ii) KVL

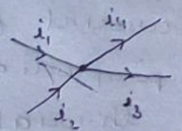
V = ⊣⊢

R = resistor symbol

$i = \xrightarrow{i}$

(i) KCL

For any junction in an electric ~~cca~~ circuit the sum of current flowing into the junction is equal to the sum of current flowing out of the conductor or the algebric sum of currents in a conductor at a point inside the conductor is zero.



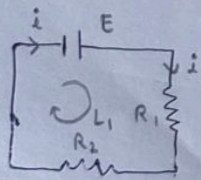
$$i_1 + i_2 - i_3 - i_4 = 0$$

$$\Sigma i = 0$$

$$i_1 + i_2 = i_3 + i_4$$

(ii) KVL : It states that the sum of voltages around a closed loop in any circuit must be equal to zero.

The net ~~Emf~~ EMF around a closed loop, is equal to the sum of potential drop across the loop.



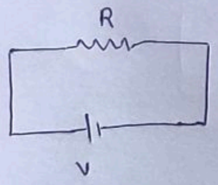
$v_1 = iR_1$ $\quad V_2 = iR_2$

(1) ⊣⊢ E is (+) ve

(2) $\xrightarrow{i}$ iR is (+)ve

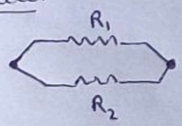
Direction of loop

Series and Parallel Combination.

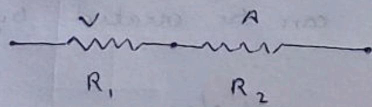


① Resistance
② Voltage
③ Current

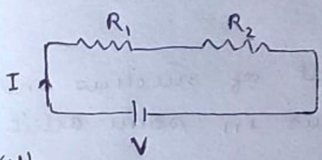
<u>Parallel</u>

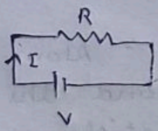


<u>series</u>



series connection





KVL

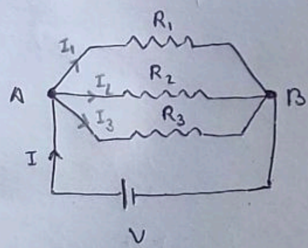
$V = IR_1 + IR_2$

$V = IR$

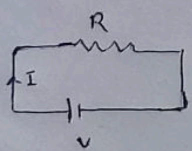
$\Rightarrow IR = I(R_1 + R_2)$

$\boxed{R = R_1 + R_2}$

Parallel Connection



Parallel combination



Equivalent circuit

KCL

$I = I_1 + I_2 + I_3$

$\Rightarrow \frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$

$\Rightarrow \boxed{\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}}$