# ELECTRICITY

Handwritten Notes

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by

Gaurav Suthar

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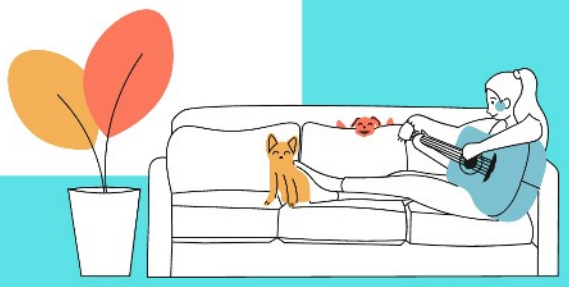

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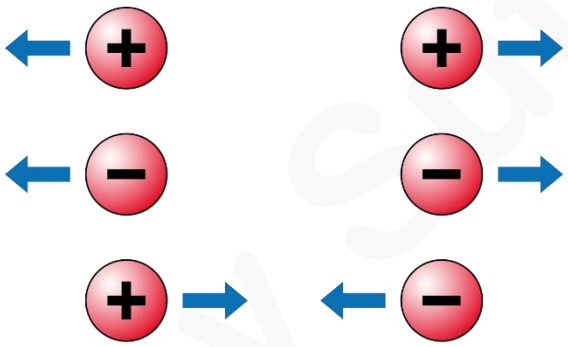
## Charge:

There are two types of Charges

1) Positive Charge
2) Negative Charge

- Same charges repel each other and different charges attract each other

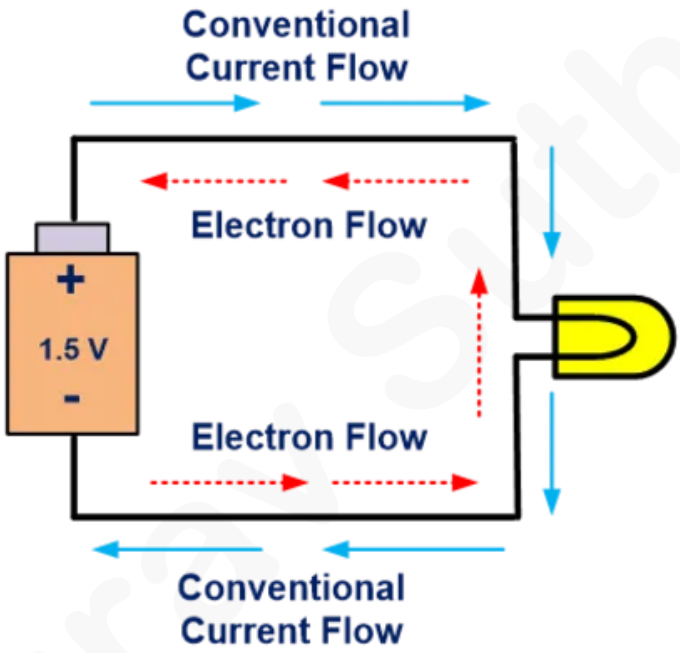


- SI unit of charge is Coulomb (C)
- 1 Coulomb means $6.24 \times 10^{18}$ electrons
- An electron has negative charge of $1.6 \times 10^{-19}$ C

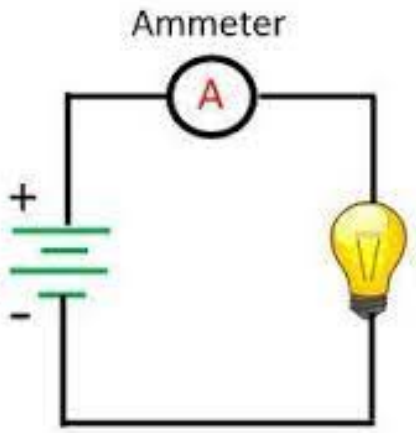
## Electric Current:

- The rate of flow of charge is called Current
- Movement of Electrons makes Current

- In an electric circuit the direction of electric current is taken as opposite to the direction of the flow of electrons.
- Means if electrons are moving in Left then current is moving in Right direction

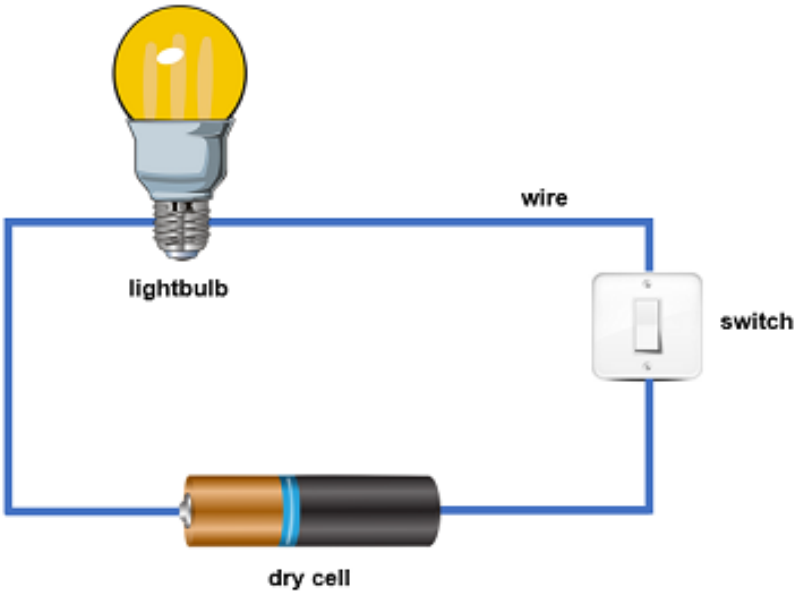



- The unit of electric current is Ampere
- $I = \frac{Q}{t}$ where I = Current, Q = Charge and t = time
- 1 Ampere current may be defined as the flow of one coulomb of charge per second.
- Current is measured by Ammeter and Ammeter is always connected in Series.




## Electric Circuit:

- Closed path of an electric current is called Electric circuit.
- If the Circuit is broken anywhere the current stops flowing.
- Electricity flows in the circuit from the Positive Terminal of the cell to the negative terminal of the cell.



## Electric Potential:

- The amount of work done in bringing a unit positive charge from infinity to that point is called Electric Potential.
- The unit of electric potential is Voltage.
- Positive Charge move from Higher Potential to Lower Potential
  Whereas Electrons moves from Lower to Higher Potential.

## Potential Difference:

Cell/ Battery की Power को Potential Difference बोलते है

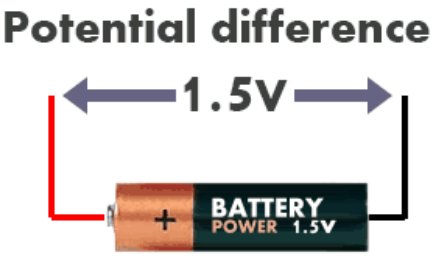
जैसे TV Remote का cell कुछ दिनों use करने के बाद ख़तम हो जाता है मतलब उसका Potential Difference कम हो गया है, नए Cell/ Battery का Potential Difference ज्यादा होता है उसे use करने पर Potential Difference कम होता जाता है time के साथ

- The amount of work done in bringing a unit positive charge from one point to another point is called Potential difference.

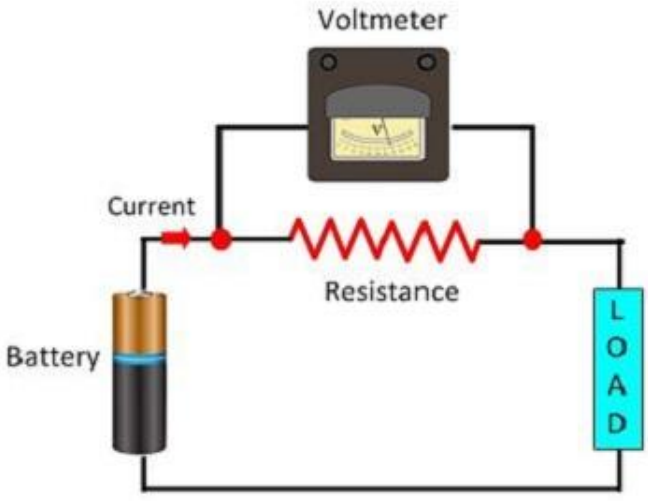
- Potential difference is created by cell or a Battery.

- $V = \frac{W}{Q}$ where V = Potential Difference, W = Workdone, Charge = Q

- SI unit of Potential difference is Volt (V)

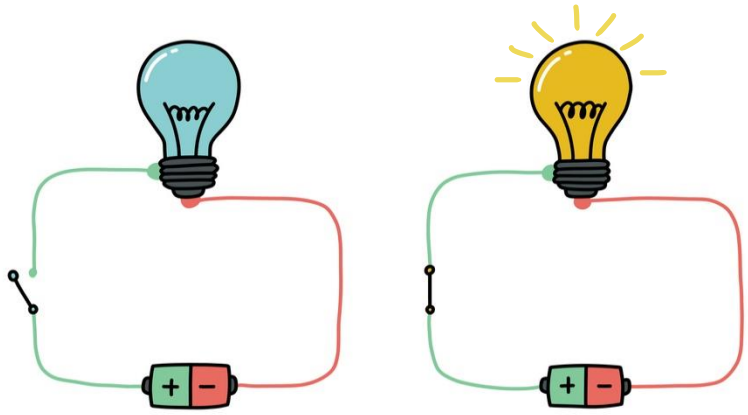



- Potential difference is measured by Voltameter and Voltmeter is always connected in Parallel.



# Circuit Diagram:

- An electric circuit contains a cell (or a battery), connecting wires, Plug key and electrical components.

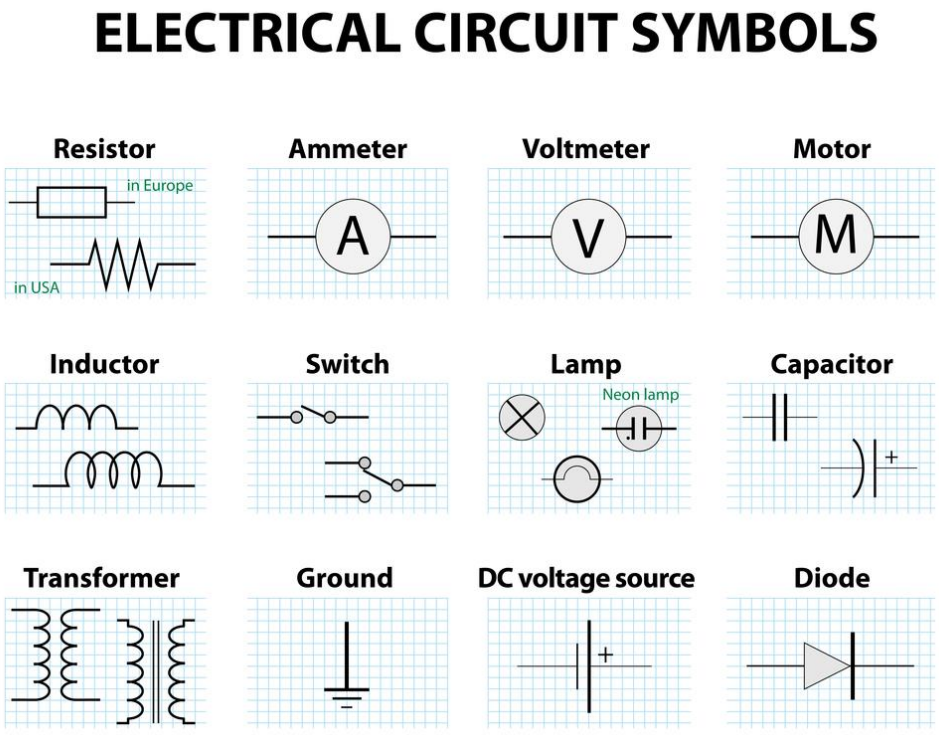


SWITCH OFF



SWITCH ON

- Symbols used in Circuit Diagram



## Ohm's Law:

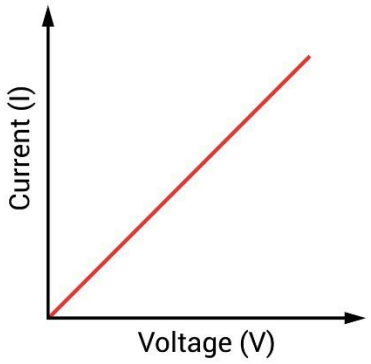
- The current passing through a circuit is directly proportional to the potential difference (Voltage)

- Potential Difference $\propto$ Electric Current

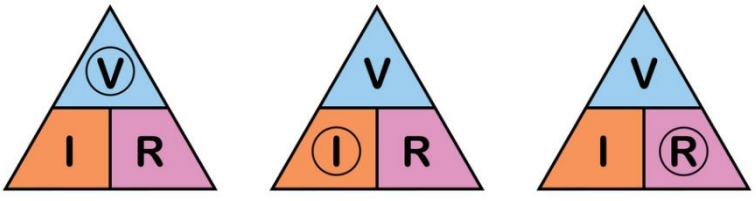
$$V \propto I$$

$$V = IR$$

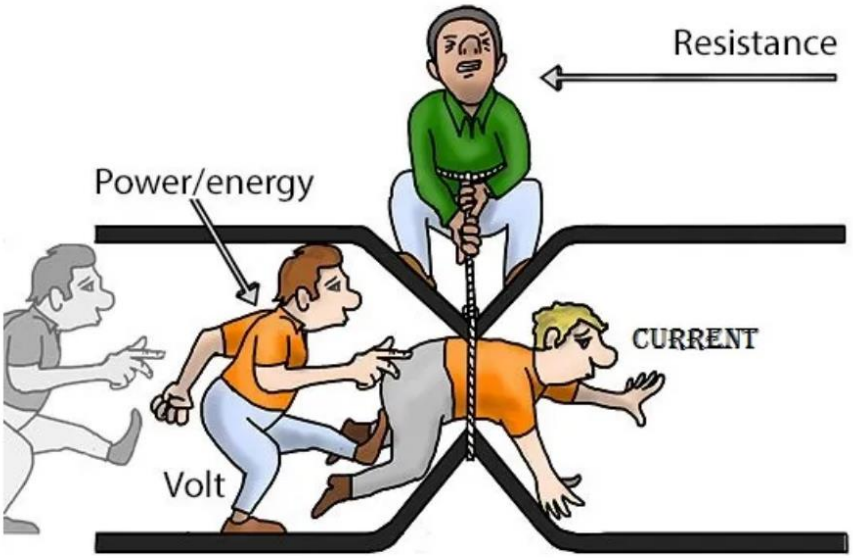
Here R is constant for the given conductor and is called Resistance.




- Ohm's Law is valid only when temperature is constant. If temperature changes resistance also changes जिसकी वजह से Ohm's Law भी change हो जाता है




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




## Resistance:

- Something that opposes the flow of current that is called Resistance.

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

- The SI unit of Resistance is ohm ($\Omega$)

- The electrical appliance which is used to oppose the current is called Resistor.
- Variable resistance (Rheostat) is the component used to increase or decrease current without changing the Voltage.

## Factors affecting Resistance

### 1) Length of conductor –

अगर wire लम्बा होगा तो Resistance भी ज्यादा होगा
और अगर wire छोटा है तो Resistance भी कम होगा


→ Low Resistance


→ High Resistance

### 2) Area of Cross- Section –

अगर wire मोटा है तो Resistance कम होगा
और अगर wire पतला है तो Resistance ज्यादा होगा


→ Low Resistance


→ High Resistance

3) Nature of Material -

ये Wire किस चीज़ से बना है उसपर depend करता है
जैसे Silver, Copper का Resistance कम होता है और वहीं पर Tungsten का Resistance ज्यादा होता है

Silver has the lowest resistance among all elements

4) Temperature -

Temperature बढ़ने से Resistance भी बढ़ जाता है

## Resistivity

- Electrical resistance of a conductor of unit cross-sectional area and unit length is called Resistivity

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

- Here, ρ (rho) is a constant of proportionality and is called the electrical resistivity.
- The SI unit of resistivity is Ωm
- Resistivity also increases if temperature increases.
- Insulators have high Resistance and Resistivity
- Conductors have low Resistance and Resistivity.

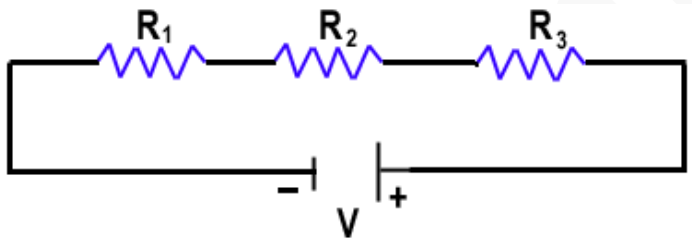
## Combination of Resistors:

- There are two types of Combinations of Resistors.

  1) Series Combination

  2) Parallel Combination

## Resistance in Series




- Same Current flows through the circuit means Same current flows through each resistor.
- Voltage will be sum of all Voltages across each resistor.
- Ohm's Law can be applied to this combination to find Equivalent Resistance.

Equivalent Resistance ($R_s$) in series combination –

$$R_s = R_1 + R_2 + R_3$$

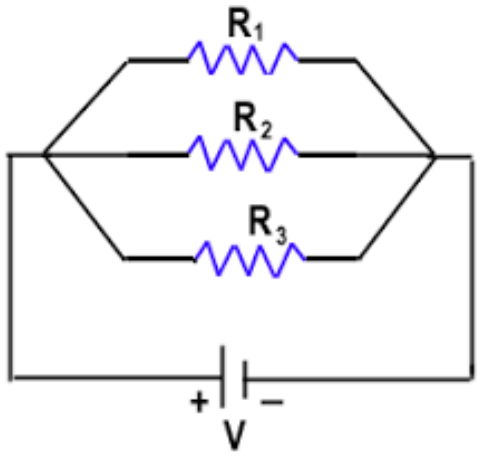
- Equivalent Resistance ($R_s$) is always greater than each individual resistance in series combination.

$R_s > R_1$

$R_s > R_2$

$R_s > R_3$

## Resistance in Parallel




- Potential difference between the two points across resistors are same.
- There will be different current flowing through each resistor.

Equivalent Resistance (Rp) in series combination –

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

- Equivalent resistance of resistors in parallel combination is always less than the individual resistances.

$R_p < R_1$

$R_p < R_2$

$R_p < R_3$

Advantage of Parallel Combination –

- In parallel combination each appliance gets the full voltage.
- If one appliance is switched on, others are not affected.

## Heating Effect of Electric Current:

- When an electric current is passed through a conductor, it generates heat due to the Resistance.
- Workdone = VQ

## Power:

- The rate of consumption of energy in an electric circuit is called Electric Power.
- $\text{Power} = \frac{\text{Workdone}}{\text{time}} = \frac{VQ}{t} = V\frac{Q}{t} = VI$
- Heat = Power x time
  = VI x t
  = IR x I x t  [Because V = IR]
  = $I^2Rt$

# Joule's law of heating:

Factors affecting Heat produced -

1) Current in Conductor -

Current के बढ़ने पर Heat भी बढ़ेगी, जैसे Transformer के wires में ज्यादा Current होता है इसलिए वो wire ज्यादा गर्म होते हैं

Because Heat is directly proportional to the square of current.

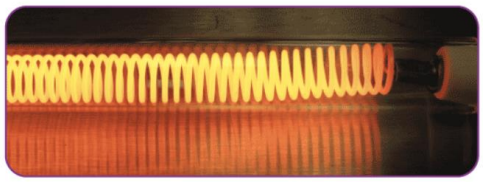
$H \propto I^2$

2) Resistance -

Resistance के बढ़ने पर गर्मी बढ़ती है, जैसे Bulb, Press (कपडे इस्त्री करने वाला press) के wires में ज्यादा Resistance होता है इसिलए वो जल्दी गर्म हो जाते हैं

Because Heat is directly proportional to the Resistance.

$H \propto R$



Electric Coil

3) Time -

अगर किसी wire में ज्यादा देर तक Current चलता रहेगा तो वो wire गर्म हो जाता है, जैसे काफी देर तक Phone को चलाने से Phone भी गर्म हो जाता है (Specially PUBG खेलते वक्त 😜)

Because Heat is directly proportional to the Time.

$H \propto T$

## Electric Bulb:

- The filament of Bulb is made of Tungsten.
- Tungsten has very high melting point (3380° C)
- Bulb के अंदर Nitrogen और Argon गैस भरी होती है जो Bulb के wire को जलने नहीं देती

## Electric Power:

- The rate at which electrical energy is consumed is called Electric Power.
- $P = VI = I^2R = \frac{V^2}{R}$
- The SI unit of Electric Power is Watt (W).
- On large scale we measure electricity or electric power as Kilowatt (1000 Watt).
- Energy is counted in (P x t) so the unit we use to measure energy consumption commercially in KWh.

1 kWh = 1000 watt × 1 hour = 1 unit = 1000 W × 3600 s

1 kWh = $3.6 \times 10^6$ watt second = $3.6 \times 10^6$ J

# CHEMICAL REACTIONS & EQUATIONS

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## Reflection & Refraction

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# Acid, Base & Salt

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# Magnetic Effects
## of Electric Current

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