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STD: X **SCIENCE - PHYSICS**

CHAPTER – 12: ELECTRICITY

* Charge is a fundamental particle in an atom. It may have positive or negative.
* SI unit of charge → Coulomb.
* 1 coulomb charge = $6x10^8$ electrons
* Charge of an electron = 1.6×10^{-19} C.

Q = ne

n → No. of electrons

e → charge of 1 electron

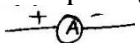
Q → Charge

* Current(I):

Rate of flow of charge

I = Q / Y

SI unit → Ampere (A)

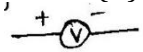
Symbol 

* Potential Difference:

Work done to move unit charge from one point to another.

V = W / Q

SI unit → Volt (V)

Symbol 

Voltmeter → An instrument to measure the potential difference.

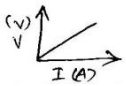
* Ohm's Law:

Potential difference across the two points of a metallic conductor is directly proportional to current passing through the circuit, temperature remains constant.

$V \propto I$

V = IR

R → Constant called resistance

V – I graph for ohm's Law. 

* Resistance:

Property of a conductor to resist the flow of charges through it.

SI unit Ohm (Ω)

Rheostat → variable resistance is a component used to regulate current without changing the source of voltage.

Factors on which Resistance of a conductor depends:

* Directly proportional to the length of conductor
* Inversely proportional to area of cross – section.
* Directly proportional to temperature and
* Depend on nature of material

Resistivity: (ρ)

Resistance offered by a cube of a material of side 1 m when current flows perpendicular to its opposite faces.

SI unit (Ωm)

Resistivity does not change with change is length or area of cross – section but it changes with change in temperatures.

Resistivity of alloy is higher than that of its constituent metals.

Alloys do not oxidize readily at high temperature, so they are commonly used in electrical heating devices.

Resistance in series:

* Total voltage $V = V_1 + V_2 + V_3$
* Voltage across each resistor

$V_1 = IR_1$

$V_2 = IR_2$

$V_3 = IR_3$

* $V = IR, + IR_2 + IR_3$
* $R = R_1 + R_2 + R_3$

Resistance in Parallel:

Total current I = $I_1 + I_2 + I_3$

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

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

Advantages of parallel combination over series combination:

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

Heating Effect of Electric current:

* If an electric circuit is purely resistive, the source of energy continually get dissipated entirely in the form of heat.
* $H = VIT$
* $H = I^2RT$

Jouel's law of heating Effect of electric current:

* Heat is directly proportional to square of current $H \propto I^2$.

* Is directly proportional to resistance for a given current $H \propto R$.

* Is directly proportional to time for which current flows through the conductor $H \propto T$.

$$H = I^2Rt$$

* Heating effect is desirable in devices like electric heater, electric iron, electric bulb, electric fuse, etc.,

* Heating effect is undesirable in devices like computer, TV, refrigerators etc.,

* Electric bulb, most of the power consumed by the filament appears a heat and a small part of it is radiated in form of light.

Filament of electric bulb is made up of tungsten because:

* Does not oxidize readily at high temperature.
* Has high melting point 3380°C.
* Bulbs are filled with chemically in active gases to prolong the life of filament.

Electric Fuse:

Safety device that protects our electrical appliances in case of short circuit or overloading.

* Fuse is made up of an alloy of lead and tin or copper & tin.
* Fuse is connected always in series with live wire.
* Has low melting point.

Electric Power:

* Rate at which electric energy in consumed or dissipated in an electric circuit.
* $P = VI$
* $P = \frac{V^2}{R}$ or $P = I^2R$
* SI unit → Watt (W)
* Commercial unit of electrical energy → Kilo watt hour (KWh)
* $1KWh = 3.6 \times 10^6 J$
* 1 KWh = 1 unit of electric energy.