

CURRENT ELECTRICITY

SUMMARY

- The current, I flowing in a conductor $I = \frac{dQ}{dt}$, where dQ is the charge that flows through a cross-section in a time interval dt . SI unit of current is ampere (A).
 $1\text{A} = 1\text{ C s}^{-1}$.
- The current density J in a conductor is the current flowing per unit area. $\left(J = \frac{I}{A} \right)$
- Current is a scalar but current density is a vector.
- The general form of Ohm's law $\vec{J} = \sigma \vec{E}$
- Practical form of Ohm's law states that $V \propto I$, or $V = IR$ where I is the current.
- The resistance R of a conductor is $R = \frac{V}{I}$. SI unit of resistance is ohm (Ω) and
 $1\ \Omega = \frac{1\text{V}}{1\text{A}}$
- The resistance of a material $R = \rho \frac{l}{A}$ where l is length of the material and A is the area of cross section.
- The resistivity of a material determines how much resistance it offers to the flow of current.
- The equivalent resistance (R_s) of several resistances (R_1, R_2, R_3, \dots) connected in series combination is $R_s = (R_1 + R_2 + R_3 + \dots)$
- The equivalent resistance (R_p) of several resistances (R_1, R_2, R_3, \dots) connected in parallel combination is $\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$
- Kirchoff's first rule (Current rule or junction rule): The algebraic sum of the currents at any junction is zero.
- Kirchoff's second rule (Voltage rule or loop rule): In a closed circuit the algebraic sum of the products of the current and resistance of each part of the circuit is equal to the total emf included in the circuit.
- Electric power is the rate at which energy is transformed.
- If a current I flows across a potential difference V , the power delivered to the circuit is $P = IV$.
- In a resistor R , the electrical power converted to heat is $P = I^2R = \frac{V^2}{R}$
- The energy equivalent of one kilowatt-hour (kWh) is $1\text{kWh} = 3.6 \times 10^6\text{ J}$.
- Metre bridge is one form of Wheatstone's bridge.
- Potentiometer is used to compare potential differences.
- Joule's law of heating is $H = VIt$ (or) $H = I^2Rt$.
- Thermoelectric effect: Conversion of temperature differences into electrical voltage and vice versa.