TN CLASS 12

CURRENT ELECTRICITY

FORMULAE SHEET

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PRIT-EDUCATION

Formula	Explanation of the terms involved	SI Units
CURRENT $I = \frac{Q}{t}$	I = letter to denote current Q=charge t=Time **Note that in this chapter , lowercase "t" refers time and upperecase "T" refers temperature.**	ampere (A)
AVERAGE CURRENT $I_{avg} = \frac{\Delta Q}{\Delta t}$	ΔQ = change in charge (q_2-q_1) $\Delta t = t_2 - t_1$ $I_{avg} = \frac{Q2-Q1}{t2-t1}$	Ampere (A)
INSTANTANEOUS CURRENT $I = \lim_{\Delta t \to 0} \frac{\Delta Q}{\Delta t} = \frac{dQ}{dt}$	ΔQ = change in charge (q_2-q_1) $\Delta t = t_2 - t_1$ **(Differentiate the average current to get instantaneous current)**	Ampere(A)
MOBILITY $\mu = \frac{e\tau}{m}$	μ=mobility m=mass e=fundamental unit charge (recall from unit 1) τ= mean free time(The average time between two successive collisions)	$m^2V^{-1}s^{-1}$
DRIFT VELOCITY $\vec{v}_d = -\frac{e\tau}{m}\vec{E}$ $\vec{v}_d = -\mu\vec{E}$	V_d=drift velocity μ=mobility $\mu = \frac{e\tau}{m}$ e=fundamental unit charge (recall from unit 1) τ= mean free time(The average time between two successive collisions)	ms^{-1}
CURRENT DENSITY (J) $J = \frac{I}{A}$	J= Current density I = current A= area	$\frac{A}{m^2}$ (or) $A\,m^{-2}$
MICROSCOPIC MODEL OF CURRENT $\vec{J} = \sigma\vec{E}$	J= Current density= CURRENT/AREA E=Electric field $\sigma = \frac{ne^2\tau}{m}$ is called conductivity.	$\frac{A}{m^2}$ (or) $A\,m^{-2}$

CONDUCTIVITY $\sigma = \frac{ne^2\tau}{m}$	σ=conductivity (reciprocal of resistivity)	**$Ohm^{-1}m^{-1}$** **Or mho/m**
RESISTIVITY $\rho = \frac{1}{\sigma} = \frac{m}{ne^2\tau}$	ρ=resistivity (reciprocal of conductivity)	**Ohm metre**
OHM'S LAW **V=IR**	V=Voltage I=current R=resistance	**V=volt** **I=ampere** **R=ohm**
RESISTORS IN SERIES $R_S = R_1 + R_2 + R_3$	Rs = effective resistance R1,R2,R3,....Rn=individual resistances connected	**OHM**
RESISTORS IN PARALLEL $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$	Rs = effective resistance R1,R2,R3,....Rn=individual resistances connected	**OHM**
TEMPERATURE DEPENDENCE OF RESISTIVITY $\frac{\Delta R}{R} = \propto \Delta T$	$\frac{\text{Change in resistance}}{\text{Original resistance}}$ = α (change. In temperature) α = temperature coefficient of resistivity	**Unit of α= Per degree Celsius or per degree Kelvin**
ELECTRICAL POWER $P = \frac{dU}{dt} = \frac{(V.dQ)}{dt} = V\frac{dQ}{dt}$	P=power U=potential energy= v x q (recall from unit 1) Q=charge t=time	**joule/sec or Watt**
INTERNAL RESISTANCE $r = \left[\frac{\varepsilon - V}{V}\right]R$	r=internal resistance ϵ=emf (electromotive force) V=potential R=resistance	**ohm**

joule's law of heating $H=I^2Rt$	H=Heat I=current R=resistance t=time	JOULE