CURRENT ELECTRICITY

Current density: $j = i/A = \sigma E$

Drift speed: $v_d = \frac{1}{2}\frac{eE}{m}T = \frac{i}{neA}$

Resistance of a wire: $R = \rho l/A$, where $\rho = 1/\sigma$

Temp. dependence of resistance: $R = R_0(1 + \alpha\Delta T)$

Ohm's law: $V = iR$

ELECTRIC CONDUCTIVITY AND RESISTIVITY :

Material	Resistivity ρ(ohmm)
Silver	1.59×10^{-8}
Copper	1.68×10^{-8}
Copper, Annealed	1.72×10^{-8}
Aluminium	2.65×10^{-8}
Tungsten	5.6×10^{-8}
Iron	9.71×10^{-4}
Platinum	10.6×10^{-8}
Manganin	48.2×10^{-8}
Lead	22×10^{-8}
Mercury	98×10^{-8}
Nichrome (Ni.Fe.Cr)	100×10^{-11}
Constantan	49×10^{-8}
Carbon (graphite)	$3 - 60 \times 10^{-5}$
Germanium	$1 - 500 \times 10^{-3}$
Silicon	$0.1 - 60$
Glass	$1 - 10000 \times 10^{9}$
Quartz (fused)	7.5×10^{17}
Hard rubber	$1 - 100 \times 10^{13}$

- **KIRCHHOFF'S LAW:**

(i) the junction law: The algebraic sum of all the currents directed towards a node is zero i.e., $\Sigma_{\text{node}} Ii = 0$.

(ii) The loop law: the algebraic sum of all the potential along a closed loop in a circuit is zero i.e., $\Sigma_{\text{loop}} \Delta V_i = 0$

Desistance in parallel: $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$

Resistance in sectors: $R_{eq} = R_1 + R_2$

Wheatstone bridge:
Balanced if $R_1/R_2 = R_3/R_4$

Electric power: $P = V^2/R = I^2R = IV$

Galvanometer as an Ammeter: $i_g G = (i - i_g)S$

Galvanometer as a Voltmeter: $V_{AB} = i_g(R + G)$

Charging of capacitors: $q(t) = CV\left[1 - e^{-\frac{t}{RC}}\right]$

Discharging of capacitors: $q(t) = q_0 e^{-\frac{t}{RC}}$

Time constant in RC circuit: $\tau = RC$

Peltier effect: emf e $= \frac{\Delta H}{\Delta Q} = \frac{\text{peltier heat}}{\text{charge transferred}}$

Seeback effect

1. Thermo-emf: $e = aT + \frac{1}{2}bT^2$
2. Thermoelectric power: $de/dt = a + bT$
3. Neutral temp: $T_n = -a/b$
4. Inversion temp: $T_i = -2a/b$

Thomson effect: emf $e = \frac{\Delta H}{\Delta Q} = \frac{\text{Thomson heat}}{\text{charge transferred}} = \sigma\Delta T$

Faraday's law of electrolysis: The mass deposited is m = Zit $= \frac{1}{F}$ Eit where I is current, Z is electrochemical equivalent, E is chemical equivalent and $F = 96485C/g$ is Faraday constant.