[9] Temprature Dependence of Resistivity :-

[1] **For Metallic Conductor** - The resistivity of a metal increases & the conductivity decreases with the increase in temprature.

- For most metals, resistivity increases linearly with increase in temprature, around & above the room temperature.

In such case resistivity (ρ) at any temprature (T) is

$$\boxed{\rho = \rho_0 [1 + \alpha (T - T_0)]} \quad \text{——— (1)}$$

Here ρ_0 = resistivity at lower Temp. (T_0) [usually $20°C$]

α = Coefficient of Resistivity.

or
$$\boxed{\alpha = \frac{\rho - \rho_0}{\rho_0 (T - T_0)} = \frac{1}{\rho_0} \frac{d\rho}{dT}}$$

Thus the temprature coefficient of Resistivity α may be defined as the increase in resistivity per unit resistivity per degree rise in temp.

Since $R = \rho \frac{l}{A}$ i.e. $R \propto \rho$

then from equation (1)

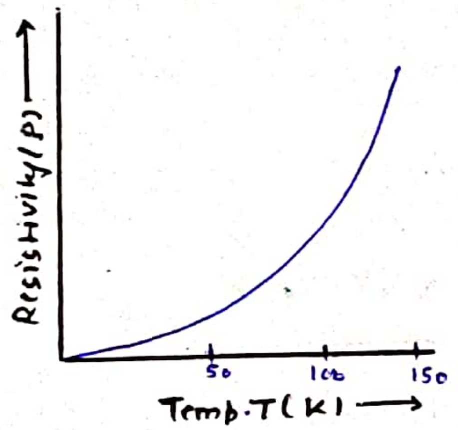
$$\boxed{R = R_0 (1 + \alpha \theta)} \Rightarrow \boxed{\alpha = \frac{R - R_0}{R_0 \times \theta}}$$

Here R = the resistance at $t°C$

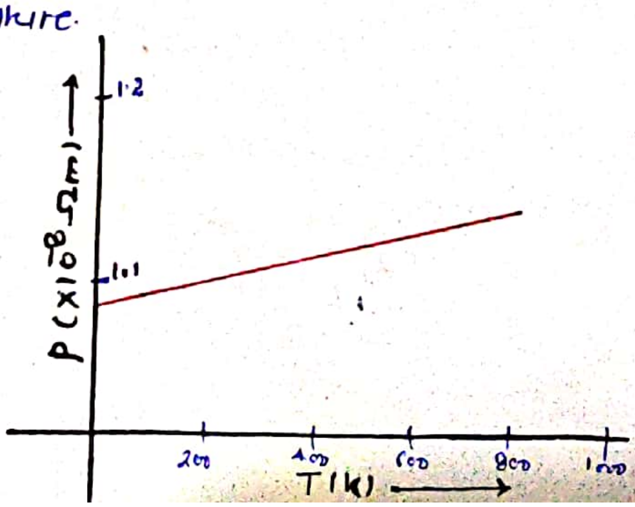
R_0 = the resistance at $0°C$

θ = rise in temperature $= (T - T_0)$

- at lower temperature, the resistivity of a pure metal increases as a high power of temperature as shown in figure (less than $0°C$)



[2] for an alloy :- In case of an alloy such as Nichrome the resistivity is very large & is very weak dependence on Temprature.



[3] For Insulator & semiconductor:- The variation of Resistivity with temp. in case of Insulator & semiconductor decreases with Increase in temperature. In this case, the resistivity at temperature (T) is given by

$$\boxed{\rho = \rho_0 \, e^{E_g/kT}}$$

Here k = Boltzmann's Constant.

E_g = Energy gap b/w valence & conduction band.