# DEDUCTION OF RADIATION LAWS FROM PLANCK'S LAW

## 1. Wien's Law:

1. Wien's law holds good when wavelength $\lambda$ is small.( $\nu$ is large)

2. Therefore $\frac{hC}{\lambda KT} >> 1$ and $e^{\frac{hC}{\lambda KT}} >> 1$

3. Neglecting 1 in equation

$$E_\lambda d\lambda = \frac{8\pi hC}{\lambda^5 [e^{\left(\frac{hC}{\lambda KT}\right)} - 1]} d\lambda = \frac{8\pi hC}{\lambda^5 e^{\left(\frac{hC}{\lambda KT}\right)}} d\lambda$$

Thus Planck's law reduces to Wien's law at **shorter wavelength**.

# DEDUCTION OF RADIATION LAWS FROM PLANCK'S LAW

## 2.Rayleigh- Jean's law:

1. Rayleigh- jean's law holds good when wavelength $\lambda$ is large.( $\nu$ is small).

2. Therefore $\frac{hC}{\lambda KT} << 1$ and expanding we get

$$e^{\frac{hC}{\lambda KT}} = 1 + \frac{hC}{\lambda KT} + \frac{\left(\frac{hC}{\lambda KT}\right)^2}{2!} + .... = 1 + \frac{hC}{\lambda KT}$$

$$E_\lambda d\lambda = \frac{8\pi hC}{\lambda^5 [1 + \frac{hC}{\lambda KT} - 1]} d\lambda = \frac{8\pi hC}{\lambda^5 \frac{hC}{\lambda KT}} d\lambda$$

$$E_\lambda = \frac{8\pi KT}{\lambda^4}$$

Thus Planck's law reduces to Rayleigh- jean's law at **longer wavelength**.

# ADVANTAGES OF PLANCK'S THEORY

1. It explains the energy spectrum of the **black body radiation.**

2. It is used to deduce **Wien's displacement law** and **Rayleigh-Jean's law**.

3. It introduces a new concept, *i.e., energy is **absorbed** or **emitted** in a* **discrete mann**er in terms of quanta of magnitude of *hv i.e.,*

$$E = nhv$$