Wein's displacement law:

* It's holds good only for shorter wavelength region of the bb radiation

The P. Law

$$P_\lambda = \frac{8\pi hc}{\lambda^5}\left(\frac{1}{e^{hc/\lambda k_B T}-1}\right)$$

If λ is less $\frac{1}{\lambda}$ will be greater.

$\therefore e^{hc/k_B T\lambda} >> 1$

Then $e^{hc/\lambda k_B T}-1 \approx e^{hc/\lambda k_B T}$

Planck's law becomes,

$$P_\lambda = \frac{8\pi hc}{\lambda^5 (e^{hc/\lambda k_B T})}$$

$$P_\lambda = 8\pi hc\, \lambda^{-5} e^{-hc/\lambda k_B T}$$

$$P_\lambda = c_1 \lambda^{-5} e^{(-c_2/\lambda T)} \rightarrow (9)$$

c_1 & c_2 → Constants

$c_1 = 8\pi hc$, & $c_2 = \frac{hc}{k_B}$

Rayleigh - Jean's law:

IIIly, It's holds good only for longer wavelength region of the bb radiation

Planck's law,

$$P_\lambda = \frac{8\pi hc}{\lambda^5}\left(\frac{1}{e^{hc/\lambda k_B T}-1}\right)$$

If x - small then

$$e^x = 1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots$$

x - small hence neglecting the higer order

$$e^x = 1 + x$$

$$\therefore e^{hc/\lambda k_B T} = 1 + \frac{hc}{\lambda k_B T}$$

The planck's law becomes,

$$P_\lambda = \frac{8\pi hc}{\lambda^5}\left(\frac{1}{1+\frac{hc}{\lambda k_B T}-1}\right)$$

$$P_\lambda = \frac{8\pi \cancel{hc}\, \cancel{\lambda} k_B T}{\cancel{hc}\,\lambda^{\cancel{5}\,4}}$$

$$P_\lambda = \frac{8\pi k_B T}{\lambda^4} \rightarrow (10)$$

Eq. (10) Rayleigh - Jean's law