wien's displacement law formula

$$\lambda_m \propto \frac{1}{T} \quad or \quad \lambda_m = \frac{b}{T} \quad or \quad \lambda_m T = b$$

$$E(\lambda)\, d\lambda = -\frac{8\pi hc}{\lambda^5} \frac{d\lambda}{e^{hc/\lambda KT} - 1}$$

$$\frac{dE(\lambda)}{d\lambda} = 0$$

$$\frac{d}{d\lambda}\left[-\frac{8\pi hc}{\lambda^5} \frac{d\lambda}{e^{hc/\lambda KT} - 1}\right] = 0$$

$$-8\,\pi\, hc \frac{d}{d\lambda}\left[\lambda^{-5}\left(e^{hc/\lambda kT} - 1\right)^{-1}\right] = 0$$

$$-8\,\pi\, hc\left[-5\,\lambda^{-6}\left(e^{hc/\lambda kT} - 1\right)^{-1} + \lambda^{-5}(-1)\left(e^{hc/\lambda kT} - 1\right)^{-2}\left(-\frac{hc}{\lambda^2 kT}\right) e^{hc/\lambda kT}\right] = 0$$

$$-8\,\pi\, hc\left[\frac{-5}{\lambda^6(e^{hc/\lambda kT} - 1)} + \frac{hc\, e^{hc/\lambda kT}}{\lambda^7 kT(e^{hc/\lambda kT} - 1)^2}\right] = 0$$

$$\frac{hc}{\lambda^7 kT}\left[\frac{e^{hc/\lambda kT}}{(e^{hc/\lambda kT} - 1)^2}\right] = \frac{5}{\lambda^6(e^{hc/\lambda kT} - 1)}$$

$$\frac{hc}{\boldsymbol{\lambda} kT} \; \frac{e^{hc/\boldsymbol{\lambda} kT}}{(e^{hc/\boldsymbol{\lambda} kT} - 1)} = 5$$

$$When\ \boldsymbol{\lambda} = \boldsymbol{\lambda}_{\mathbf{m}}, we\ have\ \frac{hc}{\boldsymbol{\lambda}_m kT} \; \frac{e^{hc/\boldsymbol{\lambda}_m kT}}{(e^{hc/\boldsymbol{\lambda}_{\mathbf{m}} kT} - 1)} = 5 \ldots \ldots (1)$$

$$Put\ \frac{hc}{k} = x \quad and \quad \boldsymbol{\lambda}_m T = b \ldots \ldots (2)$$

$$\frac{x}{b} \; \frac{e^{x/b}}{(e^{x/b} - 1)} = 5 \quad or \quad \frac{x}{b} = \frac{5\left(e^{x/b} - 1\right)}{e^{x/b}} = 5\left(1 - e^{-x/b}\right)$$

$$\frac{x}{b} = 4.9651 \quad or\ \ b = \frac{x}{4.9651} = \frac{hc}{4.965k} = 0.2892\ cm\ K$$

$$\begin{bmatrix} h = 6.63 \times 10^{-34} Js \\ c = 3 \times 10^{8} ms^{-1} \\ k = 1.38 \times 10^{-23}\, JK^{-1} \end{bmatrix}$$

$$\boldsymbol{\lambda}_m T = b = 0.2898\ cm\ K$$