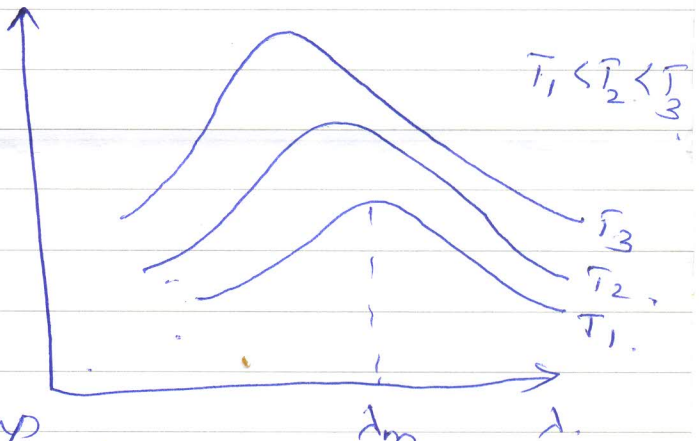
Black Body Radiation.

A perfectly black body is one which absorbs all the heat radiation of whatever wavelength incident on it. It neither reflects nor transmits any of the incident radiation and hence appears black, whatever be the colour of the incident radiation.

Eg lamp black.

A perfect absorber is a good emitter also. The graph between emissive power $E_{(\lambda)}$ and the temp was plotted as shown. The conclusions are,



1. the total energy of the radiations at any temp. is equal to the area under the curve corresponding to that temp.
2. the higher the temp of the body, the higher is the area under the curve. ie, large amount of energy is emitted by the body at higher temp.
3. The energy emitted by the body at different temp is not uniform.
4. For a given temp, there is a particular wavelength λ_m for which the energy emitted E_λ is maximum.
5. With increase of temp. of the blackbody, the maxima of the curves shift towards shorter wavelength.

Wien's displacement law.

The wavelength corresponding

to maximum intensity of emission of heat radiations decreases with increase in temp. of the black body.

$$\lambda_m \propto \frac{1}{T}$$

$$\lambda_m T = \text{a constant} = b.$$

This relation is known as Wien's displacement law. b is Wien's constant.

$$b = 2.898 \times 10^{-3} \text{ mk}.$$

Stefans law. According to stefan's law, the amount of heat radiation emitted per second from unit area of the body at absolute temp T is directly proportional to the fourth power of the temp.

$$E \propto T^4.$$

$$E = \sigma T^4$$ where σ is a constant called Stefans constant.

$$\sigma = 5.67 \times 10^{-8} \text{ W m}^{-2} \text{K}^{-4}.$$

Q. A black body has maximum wavelength 9000A° at 2000 k. What is the wavelength at 2500 k.

According to Wien's displacement law,

$$\lambda_m T = \text{a const}.$$

$$\frac{\lambda_{m_2}}{\lambda_{m_1}} = \frac{T_1}{T_2}.$$

$$\lambda_{m_2} = \frac{T_1}{T_2} \times \lambda_{m_1} = \frac{\cancel{9000} \times \cancel{2000}^{1800}}{\cancel{2500}_{5}}^{4}$$

$$= 7200 \text{ A}^\circ$$

Green house effect (Reference study).