Origin of Quantum Theory:-

Motion of mechanical objects involving distances larger than about 10^{-6} m can be explained satisfactory by laws of classical physics which is based on the following basic law's -

(i) Newton's laws of motion.
(ii) The inverse square law of gravitational attraction betn two bodies
(iii) Coulomb's inverse square law
(iv) The Lorentz force

The inadequacies of classical Mechanics are -

(i) It can not explain the non-relativistic motion of atoms electrons, protons etc.

(ii) It could not explain the stability of atoms.

(iii) It could not explain the observed variation of specific heat of metals and gases.

In spite of this classical mechanics could not explain certain phenomena such as spectral distribution of energy in black body radiation, photoelectric effect, Compton effect etc and phenomena involving distance

of the order of 10^{-10} m could not be explained by classical physics.

The failure of classical physics to explain spectral distribution of black body led Max Plank to propose the quantum hypothesis and this was the origin of quantum theory.

Black Body Radiation:-

A body having a surface which can absorb all the radiation (i.e radiation of all wavelengths) incident on it, irrespective of frequency or angle of incident is called a perfectly black body. It's coefficient of absorption and emission is 1 i.e a perfect absorber is also a perfect emitter of electromagnetic radiation. But a black body does not reflect any radiation.

A perfectly black body is an ideal conception. Lamp black and platinum black is nearest approach to a perfectly black body. Lamp black absorb about 96% and platinum black absorb 98% of the radiation incident on it.

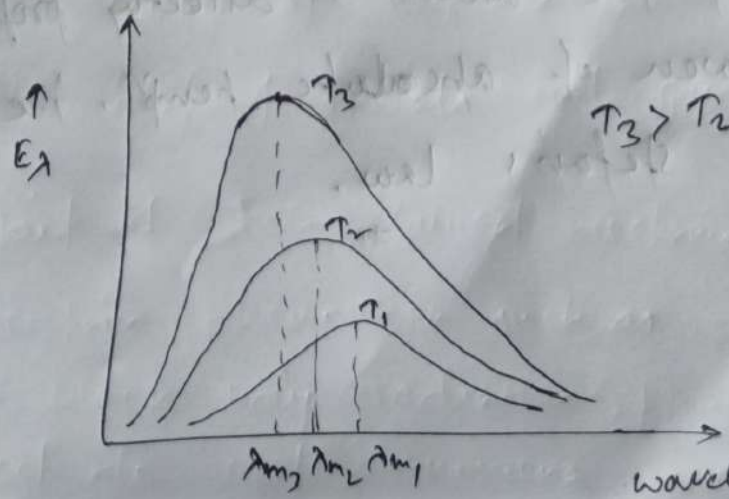
The thermal radiations which are spontaniously emitted by many ordinary objects can be approximately as black body radiation. A perfectly insulated enclosure which is in thermal equilibrium internally (i.e temperature) contains black body radiation and it can emit the radiation through a hole made in its walls provided the hole is small enough so that it does not affect the equilibrium of the enclosure, so, such an enclosure can be called a black body.

* Black body radiation is the thermal radiation emitted by a blackbody in thermal equilibrium with its environment.

Spectral distribution in Blackbody Radiation:-

Kurnmer and Pringsheim investigated the distribution of energy among the radiation emitted by a black body at different temperatures.

The spectral distribution of thermal energy radiated by black body for various temperatures is shown in fig.



The curve shows -

(i) The energy is not uniformly distributed in the radiation spectrum of a black body.

(ii) At a given temp, the intensity of radiation increases with increase with increase of wavelength and becomes max at a particular wavelength. By further increasing the wavelength, intensity of heat radiation is decreases.

(iii) An increase in temp causes a decrease in λ such that $\lambda_m T = \text{const}$

where λ_m is the wavelength for which the energy emitted is max. This relation is called wein's displacement law.

(iv) The area under each curve represent the total energy emitted by the body of a particular temp for the range of wavelengths considered. This area increase with increase of temp. It is found that the area is directly proportional to the fourth power of absolute temp, i.e $E \propto T^4$ which is Stefan's law.