EC-114

Subject : PHYSICS
Topic : Planck's Radiation law & Postulates
Class : TDc - I & Papes - II
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EC-115 Subject :

8.17 Planck's Radiation Law

Planck (1901) was able to derive an empirical formula to explain the experimentally obse distribution of energy in the spectrum of a black body, on the basis of his revolutionary hypoth known as quantum theory heat radiation. According to this theory, the energy distribution is give

$$E_\lambda \, d\lambda = \frac{8\pi hc}{\lambda^5 \left[e^{hc/k\lambda T} - 1 \right]} d\lambda$$

This relation agrees (and hence completely fit) with the experimental curves.

This formula of distribution of energy with wavelengths, on the basis of quantum theory w deduced using following assumptions, which may be called as Planck's quantum postulates or Planck hypothesis.

18 Planck's Quantum Postulates

1. A black body radiation chamber is filled up not only with radiation, but also with simple monic oscillators or resonators (energy emitters) of the molecular dimensions, known as Planck's illators or Planck's resonators, which can vibrate, with all possible frequencies. The vibration of resonator entails one degree of freedom only.

2. The oscillators (or resonators) cannot radiate or absorb energy continuously, but energy is ted or absorbed in the form of packets or quanta called photons. Planck assumed that each photon an energy $h\nu$ where h is the Planck's constant, its value being equal to 6.625×10^{-34} Joule-sec, ν is the frequency of radiation. This assumption is the most revolutionary in character. In other rds, the theory states that the exchange of energy between radiation and matter cannot take place tinuously but only in certain multiples of the fundamental frequency of the **resonator** (energy tter). As the energy of a photon is $h\nu$, the energy emitted (or absorbed) is equal to 0, $h\nu$, $2h\nu$, $3h\nu$, ... $nh\nu$, *i.e.*, in multiplets of some small unit, called as **quantum**.