

ASSIGNMENT 01:: FFBT: PHYSICS:2nd SEM

Submit the answers of this assignment within seven days through E-mail either in pdf or jpeg format

Gr. A. Planck's law of radiation: (answer any four questions)

1. If a sheet of metal is bombarded with one mole of photon with a wavelength 400nm, what amount of power is the sheet being subjected to? (1 Hz = 1cycles per sec; Speed of light = 3×10^8 m/s. $h = 6.626 \times 10^{-34}$ Js)
2. If there are three hot bodies which show the maximum radiated intensity at wavelengths $\lambda_{m1} = 340\text{nm}$ and $\lambda_{m2} = 510 \text{ nm}$. $\lambda_{m3} = 850\text{nm}$. What is the ratio of temperatures of three bodies?`
3. Does Planck's theory suggest quantized atomic energy states?
4. Draw blackbody radiation curve for three temperature T_1 , T_2 and T_3 ($T_1 > T_2 > T_3$) and show clearly that which portion of the curve is explained by the Wien's law.
5. According to Planck's quantum hypothesis what is the basic unit of energy or "Quanta of energy"?
6. Write down the Planck's black body radiation law and hence obtain the Rayleigh-Jeans law.
7. A 45 kW broadcasting antenna emits radio waves at a frequency of 4 MHz. How many photons are emitted per second?
8. Consider a 75W light bulb and an 850W microwave oven. If the wavelengths of the radiation they emit are 500 nm and 150mm, respectively, estimate the number of photons they emit per second.
9. At a given temperature, $\lambda_{\text{max}} = 6500 \text{ \AA}$ for a blackbody cavity. What will λ_{max} be if the temperature of the cavity walls is increased by double?

Gr.B. Compton's effect: (question no 1 is mandatory and answer any three from others)

1. Draw the Compton's experimental results for two different scattering angle. Now explain the following question in brief.
 - a. Why there appear two wavelengths instead of single?
 - b. Why the new wavelength is larger than that of original one?
 - c. Why there appears original wavelength?
 - d. Why the intensity (Photon counts) corresponds to new wavelength is higher than that of the original one?
 - e. Why Graphite is chosen as target?
 - f. Is it possible to get Compton's effect by ordinary light and gamma ray?
2. An x-ray photon of wavelength 0.4 \AA is scattered through an angle 45° by a loosely bound electron.
 - (i) Find the wavelength of scattered photon. (ii) What percentage of incident photon energy is lost?
3. What are the frequency, wavelength, and momentum of a photon whose energy is equal to the rest mass energy of an electron?
4. Draw the variation of Compton shift with respect to scattering angle?
5. Determine the maximum value of wavelength shift in the Compton scattering of photons from a *protons*.