DEPARTMENT OF PHYSICS
INDIAN INSTITUTE OF TECHNOLOGY, MADRAS

PH1020 Physics II

Problem Sheet 10 To be discussed on: (25.4.2018)

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1. Calculate the total energy density of radiation in a blackbody at the following temperatures: (a) 300 K and (b) 2000 K. For each temperature calculate the wavelength at which the energy density is maximum.

2. Consider a particle bound in the region $x > 0$. If its wavefunction in one dimension is given by $\Psi = e^{-x}(1-e^{-x})$, then what is the probability to find the particle to the right of $x =$ a and the expectation value $< x >$?

3. A particle, moving in one dimension, has a ground state wavefunction (not normalized and do not normalize) given by $\Psi_0(x) = e^{-\frac{\alpha^4 x^4}{4}}$ (where α is a real constant) belonging to the energy eigenvalue $E_0 = \frac{\hbar^2\alpha^2}{m}$. Determine the potential in which the particle moves.

4. Consider a particle of mass m, in one dimension, confined between to infinetely hard walls at $x = -a$ and $x = a$. If the wavefunction of the particle is given by

$$\psi(x) = \frac{1}{\sqrt{2}}\cos\left(\frac{3\pi x}{2a}\right) + \frac{1}{\sqrt{2}}\sin\left(\frac{\pi x}{a}\right)$$

then, what is the probability to find the particle to the right of x=0 and the expectation value of the energy of the particle?