**Tutorial Sheet 1: (Classical & Quantum Statistics)**

1. How many photons are present in 1.00 cm3 of radiation in thermal equilibrium at 1000 K? What is their average energy?
2. Find the probability that the speed of oxygen molecules lies between 100 and 101 m/s at 200K.
3. At what temperature will the average speed of molecules of hydrogen gas be doubled that average speed of molecules of oxygen gas at 300 K.
4. Show that the ratio of root mean square speed and the most probable speed of the molecules of an ideal gas is expressed as:
5. Find the most probable distribution of n=5 distinguishable particles among 3 cells if the intrinsic probabilities for the cells are g1=g2=g3= .
6. Prove that for long wavelengths, the blackbody radiation obeys Rayleigh – Jeans radiation law: E(λ)dλ .
7. Eight distinguishable particles are distributed in two compartments. The first compartment is divided into four cells and the second compartment is divided into two cells. Determine the thermodynamic probability of the macrostate (8, 0).
8. Fermi energy of free electrons in lithium is 4.72 eV at absolute zero. Calculate the corresponding electron density.
9. Estimate the temperature at which there is one percent probability that a state with energy 0.5 eV above the fermi energy, will be occupied by an electron.
10. Calculate the number of different ways of arranging 8 bosons in 6 phase space cells.
11. Calculate the number of different ways of arranging 10 fermions in 15 phase space cells.
12. Calculate the fermi energy in eV for sodium assuming that it has one free electron per atom. Given density of sodium = 0.97 gcm-3, atomic weight of Na =23.
13. The number of conduction electron per cm3 is 24.2 x 1022 in beryllium and 0.91 x 1022 in Cesium. If the fermi energy of conduction electron in Be is 14.14 eV. Calculate that in case of Cesium.
14. Using the expression



For electron gas, prove that at 0K, the average velocity of the electron is



Where VF is the velocity of electron at fermi energy EF.

1. Compare the Maxwell Boltzman, Bose Einstein and Fermi Dirac statistics on various basis.
2. Using the Maxwell-Boltzman molecule energy distribution,



Derive the following expression

1. Average molecular energy



1. Most probable molecular energy



1. Derive the following expression regarding Fermi Dirac statistics
2. Fermi Energy



1. Average electron energy at T=0K

