1. (a) The energy of a particle is given by $E(x) = ax^2$, where a is a constant and x is a coordinate that takes value from 0 to ∞. Calculate the average energy per particle for a system of such particles obeying Maxwell-Boltzmann distribution law, at a temperature T. Does the result is in conformity with the law of equipartition of energy?

2. Make a rough plot (using Scilab) of the energy distribution at two different temperatures (T_1, $T_2; T_1 > T_2$) for a system of free particles governed by (i) Maxwell-Boltzmann statistics

3. Partition function of monoatomic ideal gas given by $Z = V\left(\frac{2\pi m k_B T}{h^2}\right)^{3/2}$ From this relation derive the ideal gas equation.

4. If the distribution function of x is $f(x) = xe^{-x/\lambda}$ over the interval $0 < x < \infty$, the mean value of x is

   (a) λ (b) 2 λ (c) $\frac{\lambda}{2}$ (D) 0

5. What is the probability that a deuce and ace appear when two dice are thrown?

6. Let N_{MB}, N_{BE}, and N_{FD} denote the number of ways in which two particles can be distributed in two energy states according to Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics respectively. Then find $N_{MB} : N_{BE} : N_{FD}$.

7. Plot Debye's relation for specific heat and $C_v = \gamma T + \beta T^3$ on the same plot. γ and β is constant.