Quiz2 : Statistical Thermodynamics: SCI205/405 - Spring 2020 : 15 Apr 2020

Time: 30 mins Roll no. 2018113001, 2018113006, 2018113020 and 2019811001 Max. marks=25

Questions carry equal marks.

1. Consider a three-level single particle system with six microstates with energies 0, 0, ε, 2ε, 2ε, 2ε. What is the mean energy of the system if it is in equilibrium with a bath at temperature T? In the region where $\beta\varepsilon \to 0$, what will the graph of heat capacity of the system as a function of ε look like at a constant temperature?

2. Obtain (briefly derive) the criterion for an ideal gas like system to obey Classical statistics. Give one example of a real system where this criterion is violated.

3. Using the canonical ensemble theory results, show that the information entropy $S = -k_B \sum_j P_j \ln P_j$, where P_j =the probability that the system is in the energy state E_j, is the same as the statistical expression for the probability.

4. Show that Boltzmann statistics is a limiting case of quantum statistics.

5. Obtain the value for: $\frac{\Theta_{x,H_2}}{\Theta_{x,D_2}}$, for x=r(rotational) at high temperatures, without using the Tables.