Quiz : Statistical Thermodynamics: SCI205/405 - Spring 2020 : 27 Mar 2020

Time: 30 mins | Rool no. 20183011 to 201830120 and 201981101 | Max. marks=25

Questions carry equal marks.

1. Write an expression for the ionization constant at temperature T of an atom A$\rightleftharpoons A^+ + e$ in terms of the relevant microscopic quantities, assuming perfect gas like behaviour for all species. Note that the electron may be treated like a monatomic system.

2. Explain briefly how entropy is related to the degeneracy of a state with a certain energy..

3. The lower the force constant of a molecule, the higher is the population of excited vibrational states. Use a statistical result to explain this.

4. Why is the ratio of ortho and para hydrogen in ordinary hydrogen at -100K not the same as predicted for an equilibrium mixture by statistical mechanics?

5. Calculate the molar energy, Helmholtz free energy and entropy of HCl gas at 1 atm, 37°C (given : $\frac{\hbar^2}{2Ik_B} = 15.2$K; $\frac{h\nu}{k_B} = 4140$K; $D_0 = 102.2$kcal.mol^{-1}. Assume ideal behaviour.