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

Time: 30 mins | Roll No 2018113001 to 2018113004 | Max. marks=25

Questions carry equal marks.

1. Are these statement true or false : (a) According to the Boltzmann distribution, it is always less likely that a molecule is in an excited energy level compared to the ground state (b) The mean square end-to-end distance in a flexible polymer chain in solution always increases linearly with the number of residues in the chain.

2. Write an expression for the entropy change when 20 previously alphabtized books are randomized in their order.

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. The molar entropy calculated from the spectroscopic properties of CH_3D is greater than that measured calorimetrically [by integration of $S = \int_0^\infty \frac{dq_{\text{rev}}}{T} + \Delta S(\text{phase changes})$ by 2.8cal K^{-1}. How would you explain this phenomenon?

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