

AS – 5300 Physical Gas Dynamics
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Supplementary Exercise – 5
Oct 25, 2010

1. Plot the variation of $(C_v/R)_{elec}$ as a function of T/Θ_{elec} , for various integer values of g_1/g_0 . Also plot the equilibrium number fraction of molecules in the higher energy level (N_1/N) as a function of T/Θ_{elec} . Explain the behavior of the molecule.
2. Find the net C_v/R for Argon as a function of temperatures from 100 K upto 200,000 K. The requires data for Q is available on the course website.
3. Solve problem 1 with first 4 terms of the Q function. You don't really need to write out the expression but use computers and numerical differentiation (over $\Delta T=1K$) to get the energy and C_v/R values.
4. (a) Plot the variation of $(C_v/R)_{rot}$ as a function of T/Θ_{rot} .
(b) Plot the C_v/R for contributions from individual energy levels (Say for the first four of them).
(c) Calculate the sum of the contributions (from 20 levels) and compare with the first plot!
5. Work the problem 4 for Vibrational energy mode.