AS – 5680 High Temperature Gas Dynamics
Dr. T. M. Muruganandam
Supplementary Exercise – 3
Aug 20, 2012

1. Derive expressions for H, G and S for each mode of energy (trans, rot, vib) of a molecule.

2. Plot Cv/k vs T/theta for vibration mode and rotation mode. Note what the value of Cv/k is at T=theta. And find T/theta above which error of Cv/k from equipartition law is less than 1%. What is the change in the formula due to symmetry factor?
(b) Do the same for electronic level assuming only one excited level exists. Take $Q=g_o+g_1*\exp(-Theta\_elec_1/T)$

3. Find H and S as a function of T in the range of 300 to 6000K for CO2 molecule (data given below) and compare with JANAF tables. Assume that there is no dissociation.

Species	Theta_r [K]	Theta_v [K]	Q_el	Heat of formation at 298K [kJ/mol]
CO2	0.56	1915 961 961 3383	1 +1exp(-90000/T)	-393.522

4. Refer to the problem number 3. Find out at what temperatures there is change in the Cp of the gas. Try explaining all the changes in Cp of the gas.