Molecular Physics (Prof. Käs) **WS 2007/08**
Universität Leipzig
Fakultät für Physik und Geowissenschaften

Problem Set 8

Due date: December 3, 2007

Problem 28)
Calculate the wavelength of the most intense electromagnetic radiation emitted from a furnace (approximated by black body radiation) at a) 2250 K and b) 2750 K.
(3 points)

Problem 29)
Determine
(i) the zero-level energy and
(ii) the wavelength of a photon needed to excite a transition between neighboring energy levels of a harmonic oscillator of mass equal to that of a carbon atom (12.0000 u) and force constant k = 433 Nm^{-1}.
(3 points)

Problem 30)
A nitrogen molecule is confined in a cubic box of a volume of 1 L. Assuming the molecule has an energy equal to 3/2 kT at 295 K, what is the value of $n = \sqrt{(n_1^2 + n_2^2 + n_3^2)}$ for this molecule? What is the energy separation between levels n and $n+1$? What is its *deBroglie* wavelength? Would it be appropriate to describe it as behaving classically?
(4 points)

Problem 31)
Caculate the energies of the first four rotational levels of $^{1}H^{127}I$ free to rotate in three dimensions and which can be approximated as the orbital motion of a ^{1}H atom at a distance 155 pm from a stationary ^{127}I atom.
(4 points)