

Physics 330, Spring 2009
HW#8 30 points

Problems from Tipler and Llewellyn:

- 8.5 (5 points)** (a) Find the total kinetic energy of translation of 1 mole of N_2 molecules at $T = 273$ K. (b) Would your answer be the same, greater, or less for 1 mole of He atoms at the same temperature? Justify your answer.
- 8.6 (5 points)** Use the Maxwell distribution of molecular speeds to calculate $\langle v^2 \rangle$ for the molecules of a gas.
- 8.12 (5 points)** The first excited rotational energy state of the H_2 molecule ($g_2 = 3$) is about 4×10^{-3} eV above the lowest energy state ($g_1 = 1$). What is the ratio of the numbers of molecules in these two states at room temperature (300 K).
- 8.13 (5 points)** A monatomic gas is confined to move in two dimensions so that the energy of an atom is $E_k = \frac{1}{2}mv_x^2 + \frac{1}{2}mv_y^2$. What are $C_v, C_p,$ and γ for this gas? (C_p , the heat capacity at constant pressure, is equal to $C_v + nR$ and $\gamma = C_p/C_v$.)
- 8.24 (5 points)** Compute N_0/N from Equation 8-52 for (a) $T = 3T_c/4$, (b) $T = \frac{1}{2}T_c$, (c) $T = T_c/4$, and (d) $T = T_c/8$.
- 8.29(5 points)** (a) Show that the rule of Dulong-Petit follows directly from Einstein's specific heat formula (Equation 8-62) as $T \rightarrow \infty$. (b) Show that $C_v \rightarrow 0$ as $T \rightarrow 0$.