PHYSICS 101B – HOMEWORK SET 3

Reading: Tipler and Llewellyn, Sections 7.7-7.8, 8.1-8.3

Due Friday 2/16/07.

1.) Problem 7.34

2.) Problem 7.36

3.) Problem 7.39

4.) Problem 7.44

5.) Problem 7.46

6.) Problem 8.3 (Answers: 461 m/s and 1840 m/s)

7.) Problem 8.6

8.) Problem 8.9

9.) As we know, a particle with a momentum p has associated with it a wavelength λ, where the dependence of λ upon p is given by the deBroglie relation. Given this, and the Maxwell distribution of particle velocities $n(v)dv$ (equation 8-28), find the corresponding distribution $n(\lambda)d\lambda$. At room temperature ($T \simeq 300K$), what fraction of He atoms have deBroglie wavelengths between 0.99×10^{-10} and 1.01×10^{-10} meters? Answers: About 1.2%;

$$n(\lambda)d\lambda = 4\pi N(\frac{h^2}{2\pi mkT})^{3/2}\frac{1}{\lambda^4}e^{-\frac{h^2}{2mkT\lambda^2}}d\lambda$$

10.) Problem 8.13, part a) only. (Answer: R)

11.) Problem 8.17 (Answers: $5.5 \times 10^{-9}; 2.8 \times 10^{-10}; 1.3 \times 10^{-10}$)

12.) Problem 8.20

13.) Problem 8.38. What will happen to the temperature of the remaining gas as these molucules escape? What physical process does this bring to mind?

14.) Problem 8.45. There's a typo in the book; the distribution function should be $f_i = Ce^{-E_i/kT}$, not $f_i = Ce^{-E_ikT}$. (Answers: b) 0 and $\varepsilon/2$; a) and c) are

$$C = \frac{N}{1 + e^{-\varepsilon/kT}}$$

$$C_V = N_A k(\frac{\varepsilon}{kT})^2 \frac{e^{-\varepsilon/kT}}{(1 + e^{-\varepsilon/kT})^2}$$