Homework assignment 9

Due November 3, either at the start of class or in my physics department mailbox at noon.

1. Book problem 9.22
2. Book problem 9.27
3. Book problem 9.36
4. Book problem 9.43
5. The Maxwell-Boltzmann distribution takes a different form for temperatures high enough that the velocities are approaching the speed of light. There it is:

$$f(\gamma) = \frac{\gamma^2 \beta}{\theta K_2(\frac{1}{\theta})} exp\left(-\frac{\gamma}{\theta}\right) \tag{1}$$

where $\theta = \frac{k_b T}{m_e c^2}$, and K_2 is the modified Bessel function of the second kind. You do not need to know what the modified Bessel function is to solve either part of this problem, since it will contribute a factor which is not a function of γ.

(a) Find the peak value of γ for a temperature of 10^{12}K. (b) Write a computer program to find γ_{rms} for this distribution, and then plot the results as a function of T for $T = 10^9, 10^{10}, 10^{11}, \text{and} 10^{12}$K.