PHYS 2401 **Assignment 2** **Due September 30th**

Each question is worth 10

There are 5 problems and one exercise.

Problems assigned from Concepts in Thermal Physics by Blundell and Blundell

4.8, 5.4, 5.7 (you can use equation 5.27 found in problem 5.5)

(4) Calculate the fraction of nitrogen molecules with velocities between 299 and 301 m/s at 22°C.

(5) Estimate the temperature at which the v_{rms} of a nitrogen molecule in the Earth's atmosphere equals the escape velocity from earth's gravitational field. The molar mass of nitrogen gas = 28.02 g/mol, and radius of the Earth = 6,371 km, mass of Earth = 5.97219×10^{24} kg.
The escape velocity is

$$v_e = \sqrt{\frac{2GM}{r}}$$

where $G = 6.67\text{x}10^{-11} m^3 kg^{-1} s^{-2}$, M = mass of Earth and r = radius of Earth

Exercise (worth 30):

Open the excel spread sheet Maxwell Bolzmann.xls on cuLearn. The figure shows the Maxwell Bolzmann speed distributions for an ideal gas at two temperatures (cell M8 and cell M9). The molecular weights of the two gases are in cells M5 and M6.

a) Increase and then decrease the temperature of the second gas (cell M9) and comment on what happens to the width of the distribution.
b) Now increase and decrease the molecular weight of the second gas and comment on the changes to the ditribution.
c) Reset M5 = M6 = 32 and M8= 30 and M9 = 60. Determine v_{max} for each distribution (from columns B and C).
d) Using equations 5.13 and 5.14 in your text, determine <v> and v_{rms} for each distribution.
e) Calculate <v> and v_{rms} using the spreadsheet (yellow columns).

Submit a printout of the worksheet with your assignment.