Chemistry 163C Problem Set #5
Due Thursday, 5/8 at the beginning of class

1) You can use the equipartition theorem for translation and rotation to determine U for ideal gases. Follow the same procedure to determine H for a monatomic gas, a diatomic gas and a non-linear triatomic gas. The constant pressure heat capacity is given by:

$$C_P = \left(\frac{\partial H}{\partial T}\right)_P$$

The enthalpy is given by:

$$H = U + PV$$

Determine molar $C_P$ for a monatomic gas, a diatomic gas and a non-linear triatomic gas. (Hint: use the relation in example problem 15.7 in the text.) Compare your results to that reported for He, Ar, Ne, $O_2$, $N_2$, $CO_2$, HCl, and $CH_4$, respectively, at 298K as reported in Appendix A, Tables 2.3 and 2.4 of our text. Is the agreement poor, good or amazing? If there are exceptions, how would you explain the deviation?

2) Consider, once again, a two level system where the ground state is doubly degenerate and the excited state of energy ε is four fold degenerate. Use the statistical mechanical expression to determine an expression for the entropy. Evaluate S for $T \rightarrow 0$ and for $T \rightarrow \infty$. Interpret your results.

From Engel & Reid 3rd Edition, Chapter 15, Problems: 6, 15, 17, 20, 22