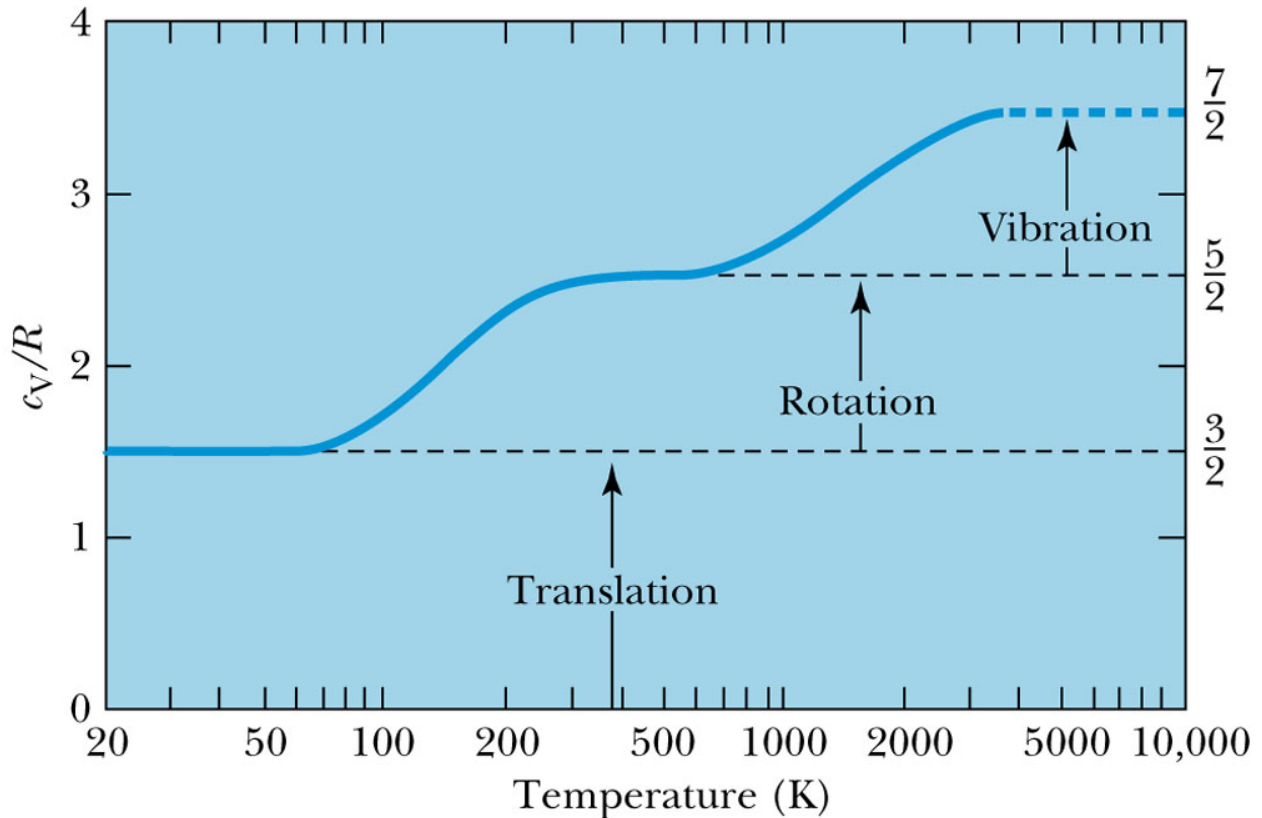# HW #2: Manipulation

1. On page 98, de Podesta used **heat capacity** data to estimate the VIBRATIONAL frequency of a diatomic oxygen molecule to be $f_0 = 4.2 \times 10^{13}$ Hz. Following a similar method, create your own ballpark ("order of magnitude") estimate of the vibrational **frequency** of diatomic molecular hydrogen:

2. Just to make sure that everyone can use *Mathematica*, try the following exercise:

A) Use the symbolic manipulation capabilities of *Mathematica* to evaluate P as a function of V, for a range of different values of γ, first for adiabatic expansions, and then for isothermal expansions.

B) Use the **Manipulate** function built into *Mathematica* to plot:
   1. P as a function of V, and
   2. T as a function of V,
      ...for both adiabatic and isothermal expansions.

3. Plot the **thermal conductivity** as a function of molecular mass, m, for the **noble gases** at 100 °C, using the data from Table 5.11 (page 105). Then re-plot the data as a function of $m^{-1/2}$. Discuss the extent to which the data agree with the theory summarized in Example 5.10. Can you think of any variation between these elements might contribute to any discrepancies you observe? Could the data be further analyzed to extract the systematics of those factors?