Homework week 9 (Part A) Due Friday Chemistry 455A
These are problems from Engel and Reid (or Engel in parentheses)
(P19.6, P19.7, P19.14)
(P8.6, P8.7, P8.14)

***P19.6*)** Show that the Morse potential approaches the harmonic potential for small values of the vibrational amplitude. (*Hint:* Expand the Morse potential in a Taylor-Mclaurin series.)

P19.7) A measurement of the vibrational energy levels of $^{12}C^{16}O$ gives the relationship $\tilde{\nu}(n) = 2170.21\left(n+\frac{1}{2}\right)\ \text{cm}^{-1} - 13.461\left(n+\frac{1}{2}\right)^2\ \text{cm}^{-1}$ where *n* is the vibrational quantum number. The fundamental vibrational frequency is $\tilde{\nu}_0 = 2170.21\,\text{cm}^{-1}$. where $\nu_o = \sqrt{\frac{k}{\mu}}$.

From these data, calculate the depth D_e of the Morse potential for $^{12}C^{16}O$. {Do not calculate the bond energy, Do, of the molecule. Just estimate Do from the dissociation energy, D_e , and discuss the relation of the bond energy, Do, to the dissociation energy, D_e. }

***P19.14*)** The rotational constant for $^{127}I\ ^{79}Br$ determined from microwave spectroscopy is 0.1141619 cm^{-1}. The atomic masses of ^{127}I and ^{79}Br are 126.904473 amu and 78.918336 amu, respectively. Calculate the bond length in $^{127}I^{79}Br$ to 2 significant figures (as per the usual approach to our problems). You might appreciate the precision of this measurement though, as you can get 10 significant figures of answer from this information.