Quiz 7.5 – Vibrational Motion

Name: _____

Harmonic Oscillator

Consider a quantum mechanical harmonic oscillator with mass equal to $8.5\ AMU$ and a force constant of $400\frac{N}{m}$. What will be the zero-point energy in (J) for this system?

Consider the same quantum mechanical harmonic oscillator introduced above in the first excited state ($v = 1$). The normalization constant for this state is: $N_1 = 1.94 \times 10^6$. You are interested in finding the probability that the oscillator will be found with a displacement between $x = -0.1\ pm$ and $x = 0.1\ pm$.

Give the integral which you would evaluate to find that probability (including the appropriate limits of integration). Also, sketch the probability distribution function with the integrated area shaded.