Problem Set 4
Quantum Harmonic Oscillator

1. For quantum harmonic oscillator with $\hbar\omega = 1$ calculate energy of transition:
a) $\Delta E_{3\to4}$ between levels *n=3*and *n=4*. b) $\Delta E_{4\to5}$ between levels *n=4*and *n=5*.

2. Calculate angular frequency for the oscillator with force constant *k*=320 N/m and mass *m*=4x10^{-18} kg.

3. Proof that $\hbar\omega = h\nu$, where $\hbar = h/2\pi$, ω-angular frequency (rad/sec) and ν-frequency in (sec^{-1})

4. Calculate the frequency in sec^{-1} which corresponds to the wavenumber $\frac{1}{\lambda} = 200$ cm^{-1}

Hint: $\nu = \frac{c}{\lambda}$, where ν is the frequency, *c*=3x10^8 m/s is speed of light, λ is the wavelength

5. Calculate Hermite polynomials a) $H_1(y)$; b) $H_2(y)$; c) $H_3(y)$