Assignment number 3 CD100 October 11, 2007 SKH

(1) Using Hermite polynomial, express the wave function for the harmonic oscillator for the first excited state. Prove that the wave-function is normalized.

(2) Prove that $\left\langle p^2 \right\rangle = \frac{5}{2}\frac{h}{2\pi(\mu k)^2}$ **and** $\left\langle x^2 \right\rangle = \frac{5}{2}\frac{h(\mu k)^2}{2\pi}$ **for n=2 in case of harmonic oscillator**

(3) Clarify Problem 15 pp187 from Mcquarrie QC

(4) Point out similarities and differences in wave functions and energies for one dimensional particle-in-a-box problem and harmonic oscillator

(5) Hermite polynomials are defined by $H_{n(z)} = (-1)^n e^{z^2}\frac{d^n e^{-z^2}}{dz^n}$

(a)verify that $H_o = 1,\ H_1 = 2z,\ H_2 = 4z^2 - 2,\ H_3 = 8z^3 - 12z$