# UCSD Physics 130b — *Quantum Mechanics* — Assignment 3

Prof. B. Keating          Assigned: October 22, 2014          Due: October 29, 2014: in Class

**LATE HOMEWORK INCURS -10%/WEEKDAY LATE, UP TO 50% MAXIMUM**
You must staple all of your sheets together. All handwritten work must be neatly written.

$\boxed{1}$ Griffiths Problem 4.33

$\boxed{2}$ Griffiths Problem 6.38

$\boxed{3}$ SHO and Perturbations

Add a cubic term $H' = 2^{\frac{3}{2}} b \sqrt{\frac{\mu^3 \omega^5}{\hbar}} x^3$ potential to the one-dimensional Simple Harmonic Oscillator. Here, $b$ is dimensionless.

(a) What is the zeroth order energy: $E_n^0$?

(b) What is the first order perturbed energy: $E_n^1$?

(c) What is the second order perturbed energy: $E_n^2$?

Hint: write the perturbation in terms of $a_+, a_-$ only.

(d) What dimensions does $\mu$ have?

$\boxed{4}$ Infinite spherical well

(a) What is the degeneracy of the ground state and first two excited states for the infinite spherical well, with radius "a"?

(b) What is the ground-state energy for an electron in a spherical well: plug in the following numbers: substitute the mass of the electron for "m" and 1 nanometer for "a"?

(c) What is the significance of this energy?