

2002S Homework #02

Due 04/09/2002

1. (Prob.2 of the Quiz held on 03/26)

(a) Determine the discrete energy levels of a particle in s -state in a spherical potential

$$\text{well } V(r) = \begin{cases} -V_0, & (r < a) \\ 0, & (r > a) \end{cases}.$$

(b) What if the particle is in l -state?

2. Determine the wave function and energy levels of a three-dimensional isotropic oscillator

$$H = \frac{\vec{p}^2}{2m} + \frac{1}{2}m\omega^2 r^2,$$

(a) in Cartesian coordinates;

(b) in spherical coordinates.

3. Two identical spin 0 particles move in one dimension under the influence of the infinite-wall potential $V=\infty$ for $x<0$, $x>L$, and $V=0$ for $0\leq x\leq L$. Write the ground-state wave function and the ground-state energy.

4. (continuation from the above problem) If the above two particles interact mutually via a very short range attractive potential $V = -\lambda \cdot \delta(x_1 - x_2)$, ($\lambda > 0$). What are the ground state wave function and the ground state energy.