

Homework 3, due 9-20

1. Consider the one-dimensional potential well

$$V(x) = \begin{cases} \infty & x < 0, x > a \\ 0 & 0 < x < a \end{cases}$$

discussed in class. Compute the ground state expectation values of x , x^2 , p , p^2 . Remember that $\hat{p} = -i\hbar d/dx$.

2. The energy eigenstates of the one-dimensional potential well are

$$E_n = \frac{\hbar^2 \pi^2 n^2}{2ma^2}, \quad (n > 0).$$

What is the ground state energy of a 0.1 kg billiard ball which is confined between two walls 1m apart? What is the corresponding (classical) velocity? What is the quantum number n corresponding to the billiard ball moving at $v = 0.1$ m/s?