

Name: _____

Do NOT simply write an answer. Give a calculation and/or reasoning that supports your answer. Circle or clearly delineate all relevant work.

1) A particle in an infinite square well ($0 \leq x \leq L$) is initially in the state, $|\psi(t=0)\rangle = \frac{1}{\sqrt{2}}(|\phi_1\rangle - i|\phi_2\rangle)$. (a) Compute the average position as a function of time, $\langle X \rangle(t)$. (b) Compute the average force applied using $m \frac{d^2}{dt^2} \langle X \rangle(t) = \langle F \rangle(t)$ and rewrite the force as a function of $\langle X \rangle$. Does this result make sense?

2) A hydrogen atom in its ground state is bound because of the Coulomb interaction, $-\frac{\alpha\hbar c}{r}$. (a) What is the average potential energy for the ground state, $\langle -\frac{\alpha\hbar c}{r} \rangle$? (b) What is the average kinetic energy, $\langle \frac{P^2}{2m} \rangle$?