Reflective Homework

Here are additional reflective problems for this week.

(1) A particle is initially in the ground state of an infinite square well. Suddenly at time $t = 0$, the well expands to twice its original size and the right wall moves from a to $2a$.

(a) What is the expectation value of energy at time $t = 0-$ and $t = 0+$ right before and after the change was made respectively?

(b) Does the expectation value of energy change with time? Explain.

(c) What is the expectation value of the position of the particle at time $t = 0-$ and $t = 0+$ right before and after the change was made? Explain whether it should depend on time or not for $t > 0$.

(2) A particle is in the ground state of the harmonic oscillator with angular frequency ω, when suddenly the spring constant quadruples, so $k' = 4k$ and $\omega' = 2\omega$.

(a) What is the expectation value of energy at time $t = 0-$ and $t = 0+$ right before and after the change was made? (Hint: Even for $t = 0+$, you can find the expectation value without calculating difficult integrals. Recall that at $t = 0-$, the expectation value of kinetic energy and potential energy in the stationary state of SHO is half of the total energy (see example problem 2.5 in the book). For finding the expectation value of energy at $t = 0+$, compare the integrals involved in the expectation value for $t = 0+$ and $t = 0-$. You will find that you need not really do any integrals at $t = 0+$ because they are the same as the integrals for $t = 0-$.)

(b) Is the conservation of energy being violated in part (a)? Explain.

(c) Does the expectation value of energy change with time? Explain.

(d) What is the expectation value of position of the particle at $t = 0-$ and $t = 0+$ right before and after the change was made? Explain whether it should depend on time or not for $t > 0$.