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Problem Set #5

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Problem Set #5  

1. A particle of mass $m$ is trapped in an infinite square well of length $L$ in energy eigenstate $n$. (a) What is the expectation value of energy measured many times? (b) If the particle’s momentum is measured once what is the magnitude of the measurement? (c) If the particle’s momentum is measured many times starting in the same state, what is the expectation value?

2. One version of the Heisenberg Uncertainty Principle is $\Delta x \Delta p_x = \alpha_x \hbar$. What is the numerical value of $\alpha_x$ for a particle of mass $m$ in an infinite square well of length $L$ in energy eigenstate $n = 5$?

3. On page 2 of SC2 there is a finite 1D well with $U_0 = 17$ eV and $L = 0.5$ nm. What is the smallest kinetic energy an electron can have so that it passes from left to right through the well without reflecting to the left?

4. An electron encountering a potential barrier of length 0.1 nm with $U_0 - E = 1$ eV has a tunneling probability of about 36%. What would the probability be for the same length but with $U_0 - E = 2$ eV? What would the probability be for $U_0 - E = 1$ and a barrier length 0.2 nm?