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## Problem Set #5

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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?