Problem Set #5 *Expectations & 1D finite wells*

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 α_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?