Time Evolution of the Infinite Square Well

Launch the "Quantum Bound States" PhET. Pause the simulation at t=0.
Make the square well potential as deep as you can on the screen to approximate an infinite well.

1. What happens to the energy levels if you:

   a) change the width of the well?
   b) change the mass of the particle?

   How your observations are consistent with the equation for the energy eigenvalues?

2. At t=0, what do the energy eigenstate wavefunctions look like?

   a) The real part?
   b) The imaginary part?
   c) The magnitude?
   d) The phase?

   How do these shapes and colors make sense?

3. At t=0, what does the probability density look like for the energy eigenstates?

   a) How is the shape of the probability density related to the shape of the wavefunction?
   b) For the n=2 energy eigenstate (in other words, the first excited state)
      i. If you were looking for the particle in the box, where is the particle most likely to be? Explain.
      ii. What is the expectation value of the position of the particle? Explain.

4. As time passes, what do the energy eigenstates do? (What do they look like?)

   a) The real part?
   b) The imaginary part?
   c) The magnitude?
   d) The phase?

   Explain why you see what you see.

5. As time passes, what does the probability density of the energy eigenstates look like?

   Explain why you see what you see.

6. Create a superposition state:

   a) What does the wavefunction look like at t=0?
   b) How does the wavefunction evolved with time?
   c) How does the probability density evolved with time?

   Explain why you see what you see.