Review Topics for Test 3

Complex Numbers

1. Convert between $z = a + bi$ form and polar form $z = |z|e^{i\phi}$ (HW 7, problems 1-3)
2. Given a complex number z, find its complex conjugate, real part, imaginary part and angle in the complex plane (HW 7, problems 1-3)
3. Apply Euler's formula (HW 7, problems 4-6)
4. Know the form of a complex traveling wave (moving right or left) and harmonic standing waves. (HW 7, problems 6-8)
5. Add, subtract, multiply and divide complex numbers (HW 7, all problems)

Chapter 5 - Schrödinger's Equation

6. Be able to plug a wave function into either the time-dependent or time-independent Schrödinger equation to determine if it is a solution. (notes, lecture)
7. Conceptually draw standing wave functions for a given potential well or barrier to show how the amplitude and wavelength vary in space as the potential changes in both classically allowed and classically forbidden regions. (HW 8, problems 30, 32, lab activity)
8. Calculate probability of finding a particle in a region $a < x < b$ given its wave function (HW 8, problem 8, 10, 14)
9. Evaluate the expectation value of x and x^2 given a wave function. Use these values to calculate the uncertainty in the position Δx. (HW 8, problem 10, 33, 34)
10. Use boundary conditions to simplify general solutions to the Schrödinger equation and find constraints on the allowed energy states (HW 8, problems 28, 30)
11. Create energy level diagrams for the infinite potential well in 1D, 2D and 3D. Identify any degeneracies present (HW 9, problems 16, 17, 19)
12. Follow the steps for solving the 1D Schrödinger equation given a problem using piece-wise constant potentials. (notes, as wells a parts of many of the Chapter 5 homework problems)
13. Use the normalization condition to solve for amplitude parameter of a wave function. Be able to do this for piece-wise functions defined on multiple domains. (HW 8, problems 8, 10, 13)
14. Calculate the probability for transmission and reflection from a step potential (notes, lecture)
15. Calculate the probability for tunneling through a potential barrier (HW 9, Chappell 1)
16. Describe the paradox of Schrödinger's cat. What aspect of quantum mechanics is Schrödinger's cat meant to highlight? (notes, lecture)

Terminology

time-dependent Schrödinger equation

time-independent Schrödinger equation

wave function

probability density

energy level

quantum number

quantum state

boundary condition

normalization condition

reflection/transmission probability

tunneling probability

superposition state