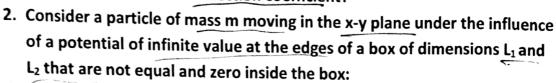
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March 7 2019.

Open Book examination.

Time 1 hour 15 minutes.

1. A plane wave is incident from the left on a one dimensional square well potential of width '2a' and height 'V' (use $-a \le x \le a$). The energy of the wave is E > V. What is the transmission probability of the wave over the potential? What is the reflection coefficient?



a. Write the Schrodinger equation for such a particle.

b. What are the eigen -functions and eigen-values of energy for this particle.

c. What are the lowest three energy state wave functions and their energies?

A. Write the wave function of the ground state and the first excited state of a simple harmonic oscillator in one dimension as a function of space x and time t.

B. Calculate the expectation values for x, x², p and p² using raising and lowering operators between all of these two states.

4. A three state system has the following operator representing the Hamiltonian (h_0 is a constant with units of energy):

$$H=h_0[2|1><1|+|2><2|+|1><2|+|2><1|+|3><3|]$$

What is the 3X3 matrix representing the Hamiltonian in this space of normalized states?

What are the energy eigen-states of the system in terms of the normalized states |1> and |2> and |3>?

If at time t=0 the state function is written as $|\Psi\rangle = a|1\rangle + 3a|2\rangle + 2a|3\rangle$

Normalize the state $|\Psi\rangle$ and find its development as a function of time.

25% per question.