Due before 9:00 am, November 18, 1999

1. Writing:

(a) Draw an energy level diagram for the diatomic molecule of mass m and spin I in a one-dimensional box of length L. Consider the noninteracting states of mass m and spin I in one-dimensional box. Let V be a potential well of depth V. The probability of reflection is given by

\[ P = \frac{\tanh(\beta V)}{\cosh(\beta V)} \]

where \( \beta = \frac{1}{kT} \) is the Boltzmann constant, \( k \) is the Boltzmann constant, \( T \) is the temperature, \( V \) is the potential energy, and \( L \) is the length of the box.

(b) Suppose that the potential well is a harmonic oscillator of frequency \( \omega \). The probability of reflection is given by

\[ P = \frac{1}{2} - \frac{1}{2} \cosh(\beta \hbar \omega) \]

2. Problem:

(a) Consider the noninteracting states of spinless fermions of mass \( m \) in a one-dimensional box. Consider the noninteracting states of spinless fermions of mass \( m \) in a one-dimensional box.

(b) Young and Freeman, Problem 4-20, p. 1311

3. Young and Freeman, Problem 4-20, p. 1311

This phenomenon in everyday life...
The following sections from the lab manual for lecture needs to be done:

1. Schrödinger

6 points

\[
\begin{align*}
\text{(f)} \\
\text{(d)} \\
\text{(c)} \\
\text{(b)} \\
\text{(a)}
\end{align*}
\]

Consider the formula of the ground state of this system in one-dimensional box of length \( L \) with infinite high walls. The total energy of the non-interacting fermions of mass \( m \) and spin \( \frac{1}{2} \) are confined in a box of length \( L \). What is the ground state and first excited state energy in terms of the parameters \( m, L, \) and \( \hbar \)?

6. Fermions – Spin \( \frac{1}{2} \)

Before starting please read the introduction and introduction to the section S5: The hydrogen atom

Section S2: Square Well

Section S3: Square Shield

In terms of the parameters \( m, L, \) and \( \hbar \),

- What is the ground state and first excited state energy in terms of the parameters \( m, L, \) and \( \hbar \)?
  - First excited state energy
  - Ground state energy