NOEN OPPGAVETEKSTER FRA KAP. 6

6.2 A particle is confined inside a cubic box with edge of length a. Show that there are six different wave functions that have $E = 14(\hbar^2\pi^2/2ma^2)$. (This is called sixfold degeneracy.)

6.3 **(a)** A particle is confined inside a rectangular box with sides of length a, a, and $2a$. What is the energy of the first excited state? Is this state degenerate? If so, determine how many different wave functions have this energy.

(b) Now assume the rectangular box has sides of length a, $2a$, and $2a$. What is the energy of the first excited state? Is this state degenerate? If so, determine how many different wave functions have this energy.

6.5 Show that L_x and L_y are Hermitian.

6.8 Show that $\hbar$ has units of angular momentum.

6.9 The operator Q obeys the commutation relation $[Q, H] = E_0 Q$, where E_0 is a constant with units of energy. Show that if $\psi(x)$ is a solution of the time-independent Schrödinger equation with energy E, then $Q\psi(x)$ is also a solution of the time-independent Schrödinger equation, and determine the energy corresponding to $Q\psi(x)$.

6.12 Consider a three-dimensional system with wave function ψ. If ψ is in the $l = 0$ state, we already know that $L_z\psi = 0$. Show that $L_x\psi = 0$ and $L_y\psi = 0$ as well. (Note this is the only exception to the rule that a wave function cannot be simultaneously an eigenfunction of L_x, L_y, and L_z.)