Postulates of Quantum Mechanics

These postulates are by no means standard like Newton's laws or the Laws of Thermodynamics; however, they are a nice way to state the underlying assumptions of quantum mechanics. At this point in time they may be a little abstract; however, we will practice using them in the next homework assignment.

1. The physical system is described by the wave function, $|\psi(t)\rangle$. (This means that there is no additional information besides the wave function. In particular there are no "hidden variables.")

2. Every measurable quantity is described by a Hermitian operator, e.g., x, p, H.

3. The only possible result of a measurement is one of the eigenvalues of the observable operator. (Thus, a position measurement will give a position, x, which is an eigenvalue of the position operator.)

4. The probability of measuring a particular eigenvalue, a_n, of an observable operator, A, is $|\langle\psi_n|\phi\rangle|^2$, where $|\phi\rangle$ is the state of the system and $|\psi_n\rangle$ is the eigenvector of A with eigenvalue a_n. If there is more than one eigenvector of A with eigenvalue a_n, then one must sum over the probabilities $|\langle\psi_n|\phi\rangle|^2$.

5. If a measurement on a state $|\phi\rangle$ of the physical quantity described by the operator A gives the eigenvalue a_n, then the state of the system immediately following the measurment is in an eigenstate of A with eigenvalue a_n.

6. The wave function evolves in time according to the Schrodinger equation,

$$i\hbar\frac{d}{dt}|\psi(t)\rangle = H(t)|\psi(t)\rangle,$$

   where $H(t)$ is the observable associated with the total energy of the system.