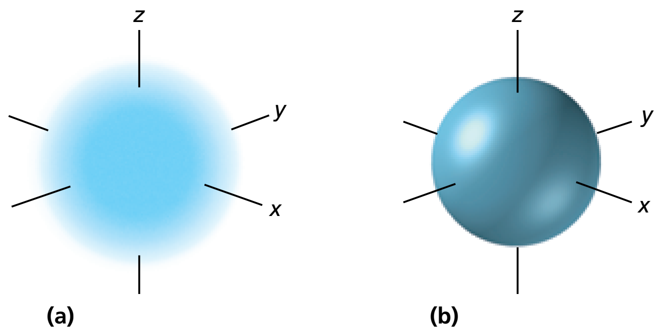

FIGURE 11 Two ways of showing a simple atomic orbital are presented. In (a) the probability of finding the electron is proportional to the density of the cloud. Shown in (b) is a surface within which the electron can be found a certain percentage of the time, conventionally 90%.

Atomic Orbitals and Quantum Numbers

In the Bohr atomic model, electrons of increasing energy occupy orbits farther and farther from the nucleus. According to the Schrödinger equation, electrons in atomic orbitals also have quantized energies. An electron's energy level is not the only characteristic of an orbital that is indicated by solving the Schrödinger equation.

In order to completely describe orbitals, scientists use quantum numbers. **Quantum numbers** *specify the properties of atomic orbitals and the properties of electrons in orbitals*. The first three quantum numbers result from solutions to the Schrödinger equation. They indicate the main energy level, the shape, and the orientation of an orbital. The fourth, the spin quantum number, describes a fundamental state of the electron that occupies the orbital. As you read the following descriptions of the quantum numbers, refer to the appropriate columns in **Table 2.**

Principal Quantum Number

The **principal quantum number,** *symbolized by n, indicates the main energy level occupied by the electron.* Values of n are positive integers only—1, 2, 3, and so on. As n increases, the electron's energy and its average distance from the nucleus increase (see **Figure 12**). For example, an electron for which $n = 1$ occupies the first, or lowest, main energy level and is located closest to the nucleus. As you will see, more than one electron can have the same n value. These electrons are sometimes said to be in the same electron *shell.* The total number of orbitals that exist in a given shell, or main energy level, is equal to n^2.

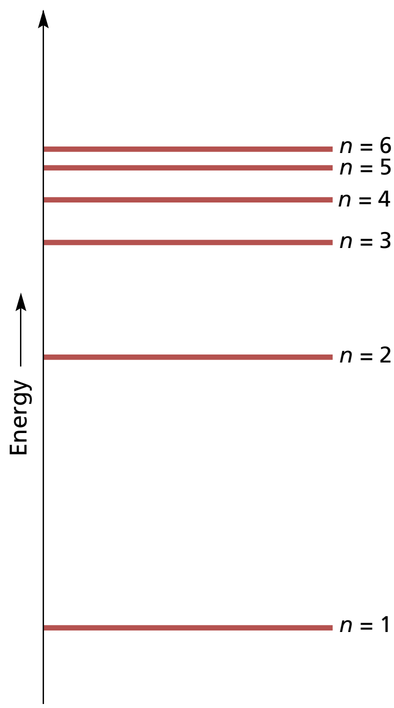

FIGURE 12 The main energy levels of an atom are represented by the principal quantum number, n.

Angular Momentum Quantum Number

Except at the first main energy level, orbitals of different shapes—known as *sublevels*—exist for a given value of n. *The* **angular momentum quantum number,** *symbolized by l, indicates the shape of the orbital.* For a specific main energy level, the number of orbital shapes possible is equal to n. The values of l allowed are zero and all positive integers less