TABLE 2 Quantum Number Relationships in Atomic Structure

Principal quantum number: main energy level (n)	Sublevels in main energy level (n sublevels)	Number of orbitals per sublevel	Number of orbitals per main energy level (n^2)	Number of electrons per sublevel	Number of electrons per main energy level ($2n^2$)
1	*s*	1	1	2	2
2	*s* *p*	1 3	4	2 6	8
3	*s* *p* *d*	1 3 5	9	2 6 10	18
4	*s* *p* *d* *f*	1 3 5 7	16	2 6 10 14	32

extension

CROSS-DISCIPLINARY

Go to **go.hrw.com** for for a full-length article on spintronics.

Keyword: HC6ARRX

As you can see in **Table 2,** the total number of orbitals at a main energy level increases with the value of n. In fact, the number of orbitals at each main energy level equals the square of the principal quantum number, n^2. What is the total number of orbitals in the third energy level? Specify each of the sublevels using the three quantum numbers you've learned so far.

Spin Quantum Number

An electron in an orbital behaves in some ways like Earth spinning on an axis. The electron exists in one of two possible spin states, which creates a magnetic field. To account for the magnetic properties of the electron, theoreticians of the early twentieth century created the spin quantum number. *The* **spin quantum number** *has only two possible values—(+½, −½)—which indicate the two fundamental spin states of an electron in an orbital.* A single orbital can hold a maximum of two electrons, which must have opposite spin states.

SECTION REVIEW

1. Define the following:
   - **a.** main energy levels
   - **b.** quantum numbers
2. **a.** List the four quantum numbers.
   - **b.** What general information about atomic orbitals is provided by the quantum numbers?
3. Describe briefly what specific information is given by each of the four quantum numbers.

Critical Thinking

4. **INFERRING RELATIONSHIPS** What are the possible values of the magnetic quantum number m for f orbitals? What is the maximum number of electrons that can exist in 4f orbitals?