CHAPTER HIGHLIGHTS

The Development of a New Atomic Model

Vocabulary
electromagnetic radiation
electromagnetic spectrum
wavelength
frequency
photoelectric effect
quantum
photon
ground state
excited state
line-emission spectrum
continuous spectrum

- In the early twentieth century, light was determined to have a dual wave-particle nature.
- Quantum theory was developed to explain observations such as the photoelectric effect and the line-emission spectrum of hydrogen.
- Quantum theory states that electrons can exist only at specific atomic energy levels.
- When an electron moves from one main energy level to a main energy level of lower energy, a photon is emitted. The photon's energy equals the energy difference between the two levels.
- An electron in an atom can move from one main energy level to a higher main energy level only by absorbing an amount of energy exactly equal to the difference between the two levels.

The Quantum Model of the Atom

Vocabulary
Heisenberg uncertainty principle
quantum theory
orbital
quantum number
principal quantum number
angular momentum quantum number
magnetic quantum number
spin quantum number

- In the early twentieth century, electrons were determined to have a dual wave-particle nature.
- The Heisenberg uncertainty principle states that it is impossible to determine simultaneously the position and velocity of an electron or any other particle.
- Quantization of electron energies is a natural outcome of the Schrödinger wave equation, which describes the properties of an atom's electrons.
- An orbital, a three-dimensional region around the nucleus, shows the region in space where an electron is most likely to be found.
- The four quantum numbers that describe the properties of electrons in atomic orbitals are the principal quantum number, the angular momentum quantum number, the magnetic quantum number, and the spin quantum number.

Electron Configurations

Vocabulary
electron configuration
Aufbau principle
Pauli exclusion principle
Hund's rule
noble gas
noble-gas configuration

- The ground-state electron configuration of an atom can be written by using the Aufbau principle, Hund's rule, and the Pauli exclusion principle.
- Electron configurations can be depicted by using different types of notation. In this book, three types of notation are used: orbital notation, electron-configuration notation, and noble-gas notation.
- Electron configurations of some atoms, such as chromium, deviate from the predictions of the Aufbau principle, but the ground-state configuration that results is the configuration with the minimum possible energy.