## Teach, *continued*

READING TOOLBOX

**Revising Preconceptions** Have students revisit their opinions from the beginning of the chapter. Have them discuss whether their opinions have changed or remained the same. Have them cite passages in the text that account for the change in or reinforcement of their opinions. LS Verbal

### *Answer to caption question*

The electrons are jumping down from an excited state to the ground state, releasing energy as photons.

## Close

### Reteaching Key Ideas

**Making Analogies** Have students come up with an analogy for what happens when atoms absorb or emit light. For example, they might compare the electron to a monetary deposit. To make an electron go up an energy level, the environment must make a deposit by allowing a photon to be absorbed. When the electron goes back down an energy level, the "deposit" is returned to the environment. Have students explain their analogies to a partner. LS Interpersonal

### Integrating Space Science

**Spectral Analysis** Astronomers use the principle that every element emits a unique set of wavelengths to learn about elements in space. This method, called *spectral analysis,* has been used to identify elements in stars. The element helium was discovered through spectral analysis of light from the sun. It was named *helium* because the Greek word for "sun" is *helios.* Helium was later found on Earth.

### Atoms absorb or emit light at certain wavelengths.

You have learned that photons are particles of light. The energy of a photon is related to the wavelength of the light. High-energy photons have short wavelengths, and low-energy photons have long wavelengths. Because atoms gain or lose energy in certain amounts, they can absorb or emit only certain wavelengths.

Because each element has a unique atomic structure, the wavelengths emitted depend on the particular element. For instance, the set of wavelengths emitted by hydrogen differs from the set of wavelengths emitted by any other element. For this reason, the wavelengths can be used to identify the substance. They are a type of "atomic fingerprint."

The emission of photons produces the light in neon signs. The wavelength of visible light determines the color of the light. For instance, the wavelengths emitted in neon gas produce the red color shown in **Figure 6.** Gases of other elements produce other colors.



**Figure 6** This neon sign lights up because atoms first gain energy from electricity and then release this energy in the form of light. **What happens to the electrons as the light is released?**

## Section 3 Review

**KEY IDEAS**

1. **State** two key features of the modern model of the atom.
2. **Explain** what determines how the energy levels in an atom are filled.
3. **Describe** what happens when an electron jumps from one energy level to another.
4. **Identify** how many electrons the third energy level can hold, and explain why this is the case.

**CRITICAL THINKING**

5. **Analyzing Models** Compare an atom's structure to a ladder. Identify one way in which a ladder is not a good model for the atom.
6. **Making Comparisons** Explain how Bohr's model and the modern model of the atom differ in terms of the path of an electron.
7. **Applying Concepts** How many valence electrons does nitrogen ($Z = 7$) have?

### Formative Assessment

Which describes the location of electrons in the modern atomic model?

**A.** They are located within the nucleus. (Incorrect. Only protons and neutrons are found in an atom's nucleus.)

**B.** They are evenly distributed throughout the atom? (Incorrect. In Thomson's atomic model, electrons are spread throughout the atom.)

**C.** They orbit in fixed paths around the nucleus of the atom? (Incorrect. In Bohr's model electrons have energy determined by their fixed path around the nucleus.)

**D.** Electrons are found in orbitals and cannot be located precisely. (Correct. The orbitals describe the most likely electron locations.)

### *Answers to Section Review*

1. Electrons can be found only in certain energy levels. Electron location cannot be predicted precisely because electrons act more like waves than like particles.

Answers continued on p. 141A