

# Counting Atoms

## SECTION 3-3

### OBJECTIVES

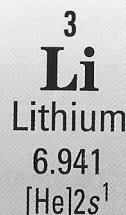
- Explain what isotopes are.
- Define *atomic number* and *mass number*, and describe how they apply to isotopes.
- Given the identity of a nuclide, determine its number of protons, neutrons, and electrons.
- Define *mole* in terms of Avogadro's number, and define *molar mass*.
- Solve problems involving mass in grams, amount in moles, and number of atoms of an element.

## Atomic Number

All atoms are composed of the same basic particles. Yet all atoms are not the same. Atoms of different elements have different numbers of protons. Atoms of the same element all have the same number of protons. The **atomic number** ( $Z$ ) of an element is the number of protons in the nucleus of each atom of that element.

Turn to the inside back cover of this textbook. In the periodic table shown, an element's atomic number is indicated above its symbol. Notice that the elements are placed in order of increasing atomic number. At the top left of the table is hydrogen, H, which has atomic number 1. Atoms of the element hydrogen have one proton in the nucleus. Next in order is helium, He, which has two protons in each nucleus. Lithium, Li, has three protons; beryllium, Be, has four protons; and so on.

The atomic number identifies an element. If you want to know which element has atomic number 47, for example, look at the periodic table. You can see that it is silver, Ag. All silver atoms contain 47 protons in their nuclei. Because atoms are neutral, we know from the atomic number that all silver atoms must also contain 47 electrons.



**FIGURE 3-8** The atomic number in this periodic-table entry reveals that an atom of lithium has three protons in its nucleus.

## Isotopes

The simplest atoms are those of hydrogen. All hydrogen atoms contain only one proton. However, like many naturally occurring elements, hydrogen atoms can contain different numbers of neutrons.