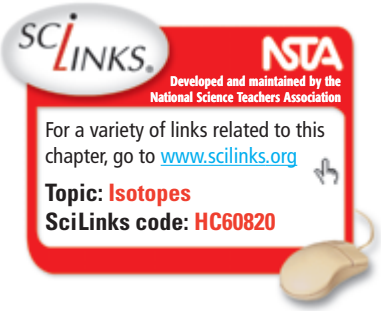
Designating Isotopes



The isotopes of hydrogen are unusual in that they have distinct names. Isotopes are usually identified by specifying their mass number. There are two methods for specifying isotopes. In the first method, the mass number is written with a hyphen after the name of the element. Tritium, for example, is written as hydrogen-3. We will refer to this method as *hyphen notation.* The uranium isotope used as fuel for nuclear power plants has a mass number of 235 and is therefore known as uranium-235. The second method shows the composition of a nucleus as the isotope's *nuclear symbol*. For example, uranium-235 is written as $^{235}_{92}U$. The superscript indicates the mass number and the subscript indicates the atomic number. The number of neutrons is found by subtracting the atomic number from the mass number.

mass number – atomic number = number of neutrons
235 (protons + neutrons) – 92 protons = 143 neutrons

Thus, a uranium-235 nucleus is made up of 92 protons and 143 neutrons.

Table 3 gives the names, symbols, and compositions of the isotopes of hydrogen and helium. **Nuclide** *is a general term for a specific isotope of an element.* We could say that **Table 3** lists the compositions of five different nuclides, three hydrogen nuclides and two helium nuclides.

TABLE 3 ***Isotopes of Hydrogen and Helium***

Isotope	Nuclear symbol	Number of protons	Number of electrons	Number of neutrons
Hydrogen-1 (protium)	$^{1}_{1}H$	1	1	0
Hydrogen-2 (deuterium)	$^{2}_{1}H$	1	1	1
Hydrogen-3 (tritium)	$^{3}_{1}H$	1	1	2
Helium-3	$^{3}_{2}He$	2	2	1
Helium-4	$^{4}_{2}He$	2	2	2

SAMPLE PROBLEM A

How many protons, electrons, and neutrons are there in an atom of chlorine-37?

SOLUTION

1 ***ANALYZE***

Given: name and mass number of chlorine-37
Unknown: numbers of protons, electrons, and neutrons

2 ***PLAN***

atomic number = number of protons = number of electrons
mass number = number of neutrons + number of protons