

COMPUTE

The mass number of chlorine-37 is 37. Consulting the periodic table reveals that chlorine's atomic number is 17. The number of neutrons can be found by subtracting the atomic number from the mass number.

$$\begin{aligned} \text{mass number of chlorine-37} - \text{atomic number of chlorine} = \\ \text{number of neutrons in chlorine-37} \end{aligned}$$

$$\begin{aligned} \text{mass number} - \text{atomic number} &= 37 \text{ (protons plus neutrons)} - 17 \text{ protons} \\ &= 20 \text{ neutrons} \end{aligned}$$

An atom of chlorine-37 contains 17 electrons, 17 protons, and 20 neutrons.

EVALUATE

The number of protons in a neutral atom equals the number of electrons. And the sum of the protons and neutrons equals the given mass number.

PRACTICE

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| 1. How many protons, electrons, and neutrons are in an atom of bromine-80? | <i>Answer</i>
35 protons, 35 electrons,
45 neutrons |
| 2. Write the nuclear symbol for carbon-13. | <i>Answer</i>
$^{13}_{6}\text{C}$ |
| 3. Write the hyphen notation for the element that contains 15 electrons and 15 neutrons. | <i>Answer</i>
phosphorus-30 |

Relative Atomic Masses

Masses of atoms expressed in grams are very small. As we shall see, an atom of oxygen-16, for example, has a mass of 2.657×10^{-23} g. For most chemical calculations it is more convenient to use *relative* atomic masses. As you read in Chapter 2, scientists use standards of measurement that are constant and are the same everywhere. In order to set up a relative scale of atomic mass, one atom has been arbitrarily chosen as the standard and assigned a relative mass value. The masses of all other atoms are expressed in relation to this defined standard.

The standard used by scientists to govern units of atomic mass is the carbon-12 nuclide. It has been arbitrarily assigned a mass of exactly 12 atomic mass units, or 12 amu. *One atomic mass unit, or 1 amu, is exactly 1/12 the mass of a carbon-12 atom.* The atomic mass of any nuclide is determined by comparing it with the mass of the carbon-12 atom. The hydrogen-1 atom has an atomic mass of *about* 1/12 that of the carbon-12 atom, or about 1 amu. The precise value of the atomic mass of a hydrogen-1 atom is 1.007 825 amu. An oxygen-16 atom has about 16/12 (or 4/3) the mass of a carbon-12 atom. Careful measurements show the atomic mass of oxygen-16 to be 15.994 915 amu. The mass of a magnesium-24 atom is found to be slightly less than twice that of a carbon-12 atom. Its atomic mass is 23.985 042 amu.