

Atomic Mass

Recall that atoms with the same number of protons but different numbers of neutrons are called **isotopes**. Isotopes are identified by including their mass number in their name. The **mass number** of an atom is the sum of the number of protons and the number of neutrons in its nucleus.

For example, carbon-14 is the isotope of carbon that has 8 neutrons in its nucleus, and carbon-12 is the isotope with 6 neutrons.

Atomic Mass Unit

Because the extremely small masses of protons, electrons, and neutrons are difficult to work with, chemists have developed a method of measuring the mass of an atom relative to the mass of a specifically chosen standard. That standard is the carbon-12 atom.

Carbon-12 has been assigned a mass of exactly 12 atomic mass units. Thus, one **atomic mass unit** (*amu*) is defined as one twelfth the mass of a carbon-12 atom.

The masses of all other elements (and their isotopes) are given relative to this standard.

Average Atomic Mass

Since carbon is the standard for the atomic mass unit, we would expect carbon to have a mass of exactly 12. According to the periodic table, however, carbon has an **atomic mass** of 12.0107 *amu*. The reason for this is that the mass on the periodic table is actually a weighted average of all isotopes of carbon.

The **average atomic mass** of an element can be calculated by adding the products of each isotope's percent abundance (as a decimal) times its atomic mass.

Example 1

Given the data in the table, calculate the average atomic mass of potassium.

Isotope	Percent Abundance	Atomic Mass
potassium-39	93.2581	38.963707
potassium-40	0.0117	39.963998
potassium-41	6.7302	40.961826

Example 2

The average atomic mass of magnesium is 24.30955 amu . Given the data in the table below, determine the percent abundance of the isotope magnesium-26.

Isotope	Percent Abundance	Atomic Mass
magnesium-24	78.7	23.98504
magnesium -25	10.13	24.98584
magnesium -26	?	25.98259

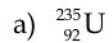
Example 3

The average atomic mass of boron is 10.811028 *amu*. Given the data in the table below, determine the percent abundance of each isotope of boron.

Isotope	Percent Abundance	Atomic Mass
boron-10	?	10.012937
boron -11	?	11.009306

Atomic Mass Worksheet

1. Identify the numbers of protons, neutrons, and electrons in a neutral atom of each of the following:



2. Complete the following table to calculate the average atomic mass of chlorine (Cl).

Isotope	Mass of Each Atom	Number of Atoms	Total Mass
Cl-35	34.969 μ	758	
Cl-37	36.966 μ	242	
Totals		1000	
Average			

3. Complete the following table to calculate the average atomic mass of each element.

Element	Symbol	Mass Number	Mass (μ)	Relative Abundance (%)	Average Atomic Mass (μ)
Carbon (C)	C-12	12	12 (exactly)	98.98	
	C-13	13	13.003	1.11	
Silicon (S)	Si-28	28	27.977	92.21	
	Si-29	29	28.976	4.70	
	Si-30	30	29.974	3.09	

4. Define the term *isotope*. Explain how an element's atomic mass is related to the abundances of its different isotopes.

5. Using the graph below, calculate the average atomic mass of copper (Cu).

