

3.4: Atomic Mass Unit

What is the mass of an atom?

Masses of individual atoms are very, very small. Using a modern device called a mass spectrometer, it is possible to measure such miniscule masses. An atom of oxygen-16, for example, has a mass of 2.66×10^{-23} g. While comparisons of masses measured in grams would have some usefulness, it is far more practical to have a system that will allow us to more easily compare relative atomic masses.

Scientists decided on using carbon-12 as the reference standard by which all other masses would be compared. A single carbon-12 atom has a mass of 1.99×10^{-23} g. We assigned one atom of carbon-12 a mass of 12 **atomic mass units** (amu). In other words, an atomic mass unit is defined as a mass equal to one twelfth the mass of an atom of carbon-12.

This means

$$1 \text{ amu} = 1.67377 \times 10^{-24} \text{ g} \quad (3.4.1)$$

This was a somewhat arbitrary decision but it makes writing and reporting the masses of elements a lot easier. As a result of this decision, the masses of all elements are written with more straightforward numbers. For example, one atom of helium-4 has a mass of 4.0026 amu. An atom of sulfur-32 has a mass of 31.972 amu.

Key Takeaways

- Carbon-12 is the reference for the atomic mass unit.
- The atomic mass unit simplifies the values written for the masses of atoms and elements

Review

1. What instrument is used to measure the mass of atoms?
2. How much does a single oxygen-16 atom weigh in grams?
3. What is the reference standard for atomic mass units?
4. How is an atomic mass unit defined?
5. Why are the numbers for atomic mass of individual atoms not whole numbers?

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