

Name _____

The Significance of Atomic Number and Atomic Mass

Open-Ended Response Answer Key

1. Atomic number can be described as the unique number of protons an element has in its nucleus. It's like the element's identity card, helping us differentiate one element from another. Atomic number is crucial because it defines the element's chemical properties and its place on the periodic table.
2. Hydrogen's atomic number of 1 indicates that it has one proton in its nucleus. This single proton defines hydrogen's identity as an element. Its atomic mass of approximately 1.008 amu accounts for the fact that it has two common isotopes: hydrogen-1 and hydrogen-2 (deuterium). The atomic mass considers the abundance of these isotopes, making hydrogen the lightest element and an essential component of stars and the universe.
3. Isotopes are atoms of the same element with different numbers of neutrons. For example, carbon has two common isotopes: carbon-12 and carbon-13. The atomic mass is calculated by considering the abundance of each isotope and their respective masses. In this case, the weighted average of carbon's isotopes is used to obtain an atomic mass of approximately 12.011 amu.
4. Let's compare hydrogen (atomic number 1, atomic mass ~1.008 amu) and helium (atomic number 2, atomic mass ~4.0026 amu). Hydrogen has one proton in its nucleus, while helium has two. This difference in atomic number results in distinct chemical behaviors, with hydrogen being a reactive nonmetal and helium being a noble gas with low reactivity. The atomic mass of helium is approximately four times that of hydrogen, reflecting its heavier atomic structure.

