

Exercise 3.3b

Atomic Weights

Name: _____

Date: _____ Per: _____

Since elements are a blend of isotopes and each isotope has a unique mass, the atomic masses on the periodic table are **weighted averages** of all isotopes of each element. For example, three isotopes of hydrogen exist in nature (Hydrogen-1, Hydrogen-2, and Hydrogen 3). The mass of hydrogen reported on the periodic table is very close to $1u$ because almost all hydrogen is Hydrogen-1. Its high abundance has the most impact on the average mass of hydrogen.

$$\text{Average Atomic Mass} = (\text{abundance}_a \times \text{mass}_a) + (\text{abundance}_b \times \text{mass}_b) + \dots$$

Example: Chlorine has 2 naturally occurring isotopes. Chlorine-35 represents 75.78% of all chlorine and has a mass of $34.969u$. Chlorine-37 represents 24.22% of all chlorine and has a mass of $36.966u$.

$$\text{Mass}_{\text{Cl}} = (0.7578 \times 34.969u) + (0.2422 \times 36.966u) = 35.45u$$

DIRECTIONS: Complete the following in the space provided.

- Boron exists in two isotopes, boron-10 and boron-11. Based on the atomic mass, which isotope should be more abundant?
- Calculate the average atomic mass of an element if 95.00% of its atoms have a mass of $31.972u$, 0.76% has a mass of $32.971u$ and 4.22% have a mass of $33.967u$. What element is this?
- The four isotopes of lead are shown below, each with its percent by mass abundance and the composition of its nucleus. Using the following data, first calculate the approximate atomic mass of each isotope. Then calculate the average atomic mass of lead.

	Isotope A	Isotope B	Isotope C	Isotope D
Protons	82	82	82	82
Neutrons	122	124	125	126
Mass				
Abundance	1.37%	26.26%	20.82%	51.55%

- Hydrogen is 99% ^1H , 0.8% ^2H , and 0.2% ^3H . Calculate its average atomic mass.
- Titanium has five common isotopes: ^{46}Ti (8.0%), ^{47}Ti (7.8%), ^{48}Ti (73.4%), ^{49}Ti (5.5%), ^{50}Ti (5.3%). What is the average atomic mass of titanium?
- There are three isotopes of silicon. They have mass numbers of 28, 29 and 30. The average atomic mass of silicon is $28.086u$. What does this say about the relative abundances of the three isotopes?
- The element europium exists in nature as two isotopes: ^{151}Eu has a mass of $150.9196u$ and ^{153}Eu has a mass of $152.9209u$. The average atomic mass of europium is 151.96 . Calculate the relative abundance of the two europium isotopes. (*Hint: The abundances must add up to 100%.*)