Part I: Atomic Mass

Use the following equation to complete the worksheet.

$$\text{Average Atomic Mass} = \left[\left(\frac{\text{\% Abundance of Isotope 1}}{100}\right) \times \text{Mass of Isotope 1}\right] + \left[\left(\frac{\text{\% Abundance of Isotope 2}}{100}\right) \times \text{Mass of Isotope 2}\right] + \ldots\text{etc.}$$

1. Use the provided the equation to calculate the average atomic mass of the two isotopes below.
   a. Calculate the average atomic mass of an element in which each isotope has a 50.00% abundance. Isotope 1 has a mass of 63.00 amu and the other has a mass of 68.00 amu. What do you notice about the average atomic mass? What is the average atomic mass in relation to the mass of isotope 1? Isotope 2?

Given:

% abundance of isotope 1: 50.00% *Mass of isotope 1*: 63.00 amu

% abundance of isotope 2: 50.00% *Mass of isotope 2*: 68.00 amu

$$\text{Average Atomic Mass} = \left[\left(\frac{\quad}{100}\right) \times \_\_\_\_\_\right] + \left[\left(\frac{\quad}{100}\right) \times \_\_\_\_\_\right]$$

   b. A different element has an isotope with an atomic mass of 72.00 amu with an 80.00% abundance. The second isotope has an atomic mass of 75.00 amu and an abundance of 20.00%. What do you notice about the average atomic mass? What is the average atomic mass in relation to the mass of isotope 1? Isotope 2?

Given:

% abundance of isotope 1: 80.00% *Mass of isotope 1*: 72.00 amu

% abundance of isotope 2: 20.00% *Mass of isotope 2*: 75.00 amu

$$\text{Average Atomic Mass} = \left[\left(\frac{\quad}{100}\right) \times \_\_\_\_\_\right] + \left[\left(\frac{\quad}{100}\right) \times \_\_\_\_\_\right]$$

2. There are 2 naturally occurring isotopes of carbon, **C-12** and **C-13**, which have a mass of 12.000 amu and 13.003 amu, respectively. Determine which isotope has a higher natural abundance **without** calculating it. How are you able to make this determination?

3. Naturally occurring lithium consists of two isotopes, **Li-6** with a mass of 6.015 amu and an abundance of 7.42% and **Li-7** with a mass of 7.016 amu. Start by filling out the table below and then calculate the atomic mass of lithium. Show all your work and then compare your answer with the value given on the periodic table.

Given:

% abundance of isotope 1 (Li-6): _____ *Mass of isotope 1 (Li-6)*: _____

% abundance of isotope 2 (Li-7): _____ *Mass of isotope 2 (Li-7)*: _____

$$\textbf{Average Atomic Mass} = \left[\left(\frac{\textbf{\% Abundance of Li-6}}{\textbf{100}}\right) \textbf{ x Mass of Li-6}\right] + \left[\left(\frac{\textbf{\% Abundance of Li-7}}{\textbf{100}}\right) \textbf{ x Li-7}\right]$$

4. Mg has three naturally occurring isotopes: **Mg-25** (10.03% abundance with a mass of 24.9858 amu) and **Mg-26** (11.70% abundance with a mass of 25.9826 amu).
   a. Fill in the following table with any of the information you are given.

% abundance of isotope 1 (Mg-24): _____ *Mass of isotope 1 (Mg-24)*: _____

% abundance of isotope 2 (Mg-25): _____ *Mass of isotope 2 (Mg-25)*: _____

% abundance of isotope 3 (Mg-26): _____ *Mass of isotope 3 (Mg-26)*: _____

How can you determine the % abundance of Mg-24?

   b. Next, you are going to be asked to calculate the mass of Mg-24. Rearrange the average atomic mass equation to calculate the mass.

$$\textbf{Average Atomic Mass} = \left[\left(\frac{\text{\% Abundance of Mg-24}}{100}\right) \times \text{Mass of Mg-24}\right] + \left[\left(\frac{\text{\% Abundance of Mg-25}}{100}\right) \times \text{Mg-25}\right] + \left[\left(\frac{\text{\% Abundance of Mg-26}}{100}\right) \times \text{Mg-26}\right]$$

   c. Calculate the mass of Mg-24.

5. Chlorine has two naturally occurring isotopes, Cl-35 has a mass of 34.969 amu and a natural abundance of 76.0%. Find the mass of the heavier isotope, Cl-37. Show your work.

6. Silicon has three naturally occurring isotopes, Si-28 has a mass of 27.977 amu and a natural abundance of 92.230%, Si-29 has a mass of 28.976 amu and a natural abundance =of 4.683%. Find the mass of the third isotope, Si-30. Show your work.

7. Uranium has 3 main isotopes, ^{238}U, ^{235}U, and ^{234}U.

a. Use the periodic table to determine the average atomic mass of Uranium.

b. The natural abundance of ^{238}U is 99.28% and ^{234}U 0.0054%. What is the natural abundance ^{235}U?

c. If the mass of ^{235}U is 235.044 amu and the mass of ^{234}U is 234.040 amu. What is the amu of ^{238}U?

8. The provided table lists the mass and natural abundance of 4 isotopes. Use this information to determine the average atomic mass of the unknown element. What is the identity of this iosotope?

Isotope	Mass (amu)	Natural Abundance
W	203.9730	1.400 %
X	205.9744	24.10 %
Y	206.9758	22.10 %
Z	207.9766	52.40 %

Part II: Constant Composition

The law of constant composition states that matter can be neither created nor destroyed. This means that in a chemical reaction, the sum of the mass of the reactants must be equal to the mass of the products. Use the below equation to answer questions **9**- **12**.

9. Copper(I) chloride is a compound that contains just copper and chlorine. One sample of the compound produces 35.31 g of copper and 19.69 g of chlorine. A second sample weighs 145 g. How many grams of copper are in this second sample?

10. Methane is a compound that contains just hydrogen and carbon. A sample of methane gas is found to be 74.9% carbon by mass. If a second sample of methane contains 34.0 g of carbon, how many grams of hydrogen must it contain?

11. Glucose is a compound that contains only carbon, hydrogen and oxygen. A 14.5 g sample of glucose is found to contain 5.80 g of carbon and 0.972 g of hydrogen. How many grams of oxygen must there be in a second sample of glucose that weighs 21.7 g?