Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_\_\_\_\_

**LAB: Average Mass of M&Mium (CB)**

**Background**:

The extremely small size of atoms makes it impossible to count them or determine their individual masses using direct means. An instrument called a mass spectrometer allows for such determinations. The average atomic masses depend on the number and masses of the isotopes of an element.

Isotopes are atoms of the same atomic number having different masses due to different numbers of neutrons. The atomic mass of an element is the weighted average of the masses of the isotopes of that element. The weighted average takes account both the mass and relative abundance of each isotope as it occurs in nature.

**Equation**:

Atomic Mass = (Massisotope 1)(% abundance) + (Massisotope 2)(% abundance) + …

**Introduction:**

Congratulations! You have discovered a new element—M&Mium (Symbol: Mm)! There are 3 isotopes of your new element: plain, peanut and peanut butter. In order to officially declare your element discovered, you must calculate the average atomic mass. Follow the procedure below carefully to calculate your element’s average atomic mass.

**Materials**: 1 bag of isotope samples (various M&Ms), Calculator, Lab Sheet

**Procedure:**

1. Open your bag of M&Ms. Separate them by type (small plain, large plain, and pretzel). Place one of each type of M&M on the scale *(one at a time)* to determine the **Mass of One Piece**. Record this in your data table.
2. Count how many there are of each type and enter this into your data table. (**# in Bag**)
3. Calculate the **Abundance** of each isotope using the formula below: (this number should be a decimal)

# of M&Ms of one type

Total # of M&Ms

1. Calculate the **Weighted Mass** for each isotope by multiplying the mass of the isotope (from #1) by each abundance from #2.

Mass Number x Abundance

1. Repeat for each isotope.
2. To find the **average atomic mass** of M&Mium, add up the **Weighted Mass** for all the isotopes.

**Data:**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **M&M Type** | **Mass of One Piece** | **# in Bag** | **Abundance** | **Weighted Mass** |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
| **Average Atomic Mass of M&Mium:** | | | |  |

**Conclusion Questions:**

1. Does any single isotope of M&Mium have a mass exactly equal to the average atomic mass of the element? Why/why not?
2. Which isotope mass was your calculated *average* atomic mass of M&Mium closest to? Does this make sense? Why or why not?
3. How does your atomic mass for M&Mium compare to that of other groups? Why would there be a difference in your numbers?
4. If you were to discover another isotope of M&Mium: Peanut butter with a mass of 2.02 grams. How would this impact the average atomic mass of M&Mium? How do you know?
5. If the abundance of peanut M&Ms you had was to increase by 20% and the abundance of plain M&Ms you had was to decrease by 20%, how would this impact the average atomic mass of M&Mium? How do you know?

**\*\*\*KEY POINT: To Find the Average Atomic Mass of an Element:**

**Example**:

Carbon has two isotopes Carbon-12 with an abundance of 98.90% and Carbon-13 with an abundance of 1.10%. What is the average atomic mass for Carbon?

Isotope A: Mass = Percent Abundance =

Isotope B: Mass= Percent Abundance=

**Average atomic mass of Carbon =**