Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period Score \_\_\_\_\_\_ / 20

**The Beanium Lab Activity (aka Isotopes and Average Atomic Mass)**

For elemental samples, a mass spectrometer is used to measure the masses of each isotope as well as their relative abundance. The results of these analyses is reported in the table of natural abundances. <https://www.chem.ualberta.ca/~massspec/atomic_mass_abund.pdf>

Problem: Take a sample containing several different types of beans. Each type of bean represents an isotope of the element Beanium. Each individual bean represents an atom of the element Beanium. Your job is to determine:

-the relative abundance (%) of each isotope

-the average mass of each bean

-the average atomic mass, in grams, of the element Beanium.

Materials and Equipment: -Mixture of beans, Triple beam or electronic balance, Plastic cups

Procedure:

1. Obtain a sample of the classroom mixture of Beanium.
2. Sort your Beanium into its three isotopic bean types.
3. Count the number of beans in each pile.
4. Find the mass of each pile of beans.
5. Determine the average mass of each type of bean based on the samples’ masses.
6. Separately find the mass of two individual beans, one at a time, of each type of bean.
7. Perform all necessary calculations and answer all questions.
8. Record all data in the data table and **be sure to include correct units.**

Data: (5 pts)

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Bean 1** | **Bean 2** | **Bean 3** |
| **Name of bean**  **(describe)** |  |  |  |
| **Number of beans in sample** |  |  |  |
| **Mass of beans in sample** |  |  |  |
| **Average mass of one bean from your sample** |  |  |  |
| **Masses of 2 individual beans** | **1)**  **2)** | **1)**  **2)** | **1)**  **2)** |

**Calculations and Questions:**

1. Why do we find and use the average mass of each “isotope” (type of bean) and not just simply use the individual mass of one bean? Is this an issue with actual atoms? i.e. are all atoms of the same isotope identical to one another? Why or why not? (2 pts)
2. What is the total number of “atoms” in your entire Beanium sample? (1 pt) \_\_\_\_\_\_\_\_\_\_\_\_
3. What is the total mass of your entire Beanium sample? (1 pt) \_\_\_\_\_\_\_\_\_\_\_\_\_
4. What is the percent abundance of each “isotope” (type of bean) in your sample based on the total number of “atoms” you used? Show all work! (3 pts)

Bean 1 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Bean 2\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Bean 3\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. What is the average atomic mass of a Beanium “atom”? Show all work! (Use the average mass from the data table and the abundances from #4.) (3 pts) \_\_\_\_\_\_\_\_\_\_\_\_
2. Explain the significance of this lab with respect to actual atoms of elements. Are all atoms of one element the same? Why or why not? Why do we refer to the AVERAGE atomic mass of an element on the periodic table? Is the average atomic mass the actual mass of every atom? (2 pts)
3. Find the atomic masses and natural abundances for all the isotopes of Antimony using the table of natural abundances. Calculate the atomic mass from this data and compare to the atomic mass for Antimony on the periodic table. (3 pts)