Laboratory Investigation Name ______________________

Chemistry: Form L2.6A Date ______________ Period ____

The Atomic Mass of Beanium

based on a concept by *Kathleen Davies*

PROBLEM

How is the average mass of isotopes determined?

INTRODUCTION

Imagine a new element has been discovered, and has been given the name "beanium". Students at local high schools have been given the job of determining the number of isotopes of this new element, the mass of each isotope, the abundance of each isotope and the "atomic weight" of the new element. Fortunately, beanium atoms are very large, so you will be able to sort and weigh them easily. In this laboratory investigation, you will determine the abundance of each "isotope" of beanium, and determine the average mass (atomic weight) of the element in much the same way the average mass of other elements is determined. Then you will compare your result to a standard measurement of average mass.

MATERIALS (*per group*)

a sample of atoms of the new element, balance

PROCEDURE

1. Determine the number of isotopes of beanium based upon the appearance (size, color, etc.). Draw a picture of each isotope in the first column of the data table, *Method 1*, on the next page.

2. Sort the beanium atoms into groups based on appearance. Each group represents a different isotope. Count the total number of atoms of each isotope and record the result in the second column of the data table, *Method 1*, on the next page. Add those numbers to get the total number of atoms in your sample. Record the total in the data table.

3. Determine the abundance of each isotope using the formula below:

$$abundance = \frac{number\ of\ atoms\ of\ each\ isotope}{total\ number\ of\ atoms}$$

   Record the results in the third column of the data table, *Method 1*, on the next page.

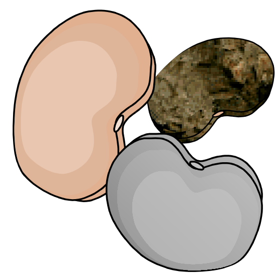
4. Using a balance, measure the total mass of all the atoms of each isotope. Record the total mass in the fourth column of the data table, *Method 1*, on the next page.

5. Find the mass of a typical atom of each isotope by dividing the total mass by the number of atoms of that isotope. Record the result in the fifth column of the data table, *Method 1*, on the next page.

6. Multiply the abundance of each isotope by its mass to find the product, and record the result in the last column of the data table, *Method 1*, on the next page.

7. Add the products in the last column to find the "atomic weight" of the element beanium. Record the result in the data table, *Method 1*, on the next page.

8. Put all the "beanium atoms" on the balance at once. Measure their mass. Record the results in the data table, *Method 2*, on the next page.



"Beanium atoms" look strangely like bean seeds

9. Count the number of "beanium atoms" on the balance. Record the results in the data table, *Method 2*, below.

10. Find the average mass of "beanium" by dividing the mass of all the "beanium atoms" by the number of "beanium atoms." Record the results in the data table, *Method 2*, below.

OBSERVATIONS

Method 1

Isotope	Drawing	Number of atoms	Abundance	Total mass (g)	Mass of isotope (g)	Product (g)
1						
2						
3						
	TOTAL				Atomic mass of "Beanium"	

Method 2

Mass of all the "beanium atoms"	Number of "beanium atoms"	Average mass of "beanium"

CONCLUSIONS

1. How does the atomic mass of beanium (*Method 1*) compare to the average mass of beanium (*Method 2*)? Why? ______________________________

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2. Why isn't the atomic mass of most of the elements on the *Periodic Table* an integer? ___

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3. If heaviest isotope were more abundant, and the other two isotopes were less abundant, would happen to the atomic weight of beanium? Why? ______________________________

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4. How is the average mass of an element calculated? Which method, *Method 1* or *Method 2*, is most like this procedure? ______________________________

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