Name: _____ Lab Partner_____

Date: _____

Lab: Isotopes and Average Atomic Mass

Purpose [2]: _____

_____

Introduction [Summaries 3]

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 into account both the mass and relative abundance of isotope as it occurs in nature. The relative abundance and masses of small atomic particles are measured in the laboratory by an instrument called a mass spectrometer. The mass spectrometer separates particles by mass and measures the mass and relative abundance of each. From these data, the weighted average is calculated to determine the atomic mass of the element.	
In this lab you will carry out experiments and perform the necessary calculations to determine the atomic mass of the fictitious element vegium. The three different isotopes of vegium or beanium, peaium, and cornium. As in real elements, these isotopes are collections or particles having different masses. Your job will be to obtain a sample of vegium and determine the relative abundance of each isotope and the mass of each type of particle. From this data you will calculate the weighted average mass, or atomic mass, of vegium. Unlike real isotopes, the individual isotopic particles of vegium differ slightly in mass, so you will determine the average mass of each type of isotopic particle. Then you can calculate the weighted average mass, or "atomic mass" of vegium.	

Safety

Behave in a way that is consistent with a safe laboratory environment

Apparatus

Electronic Laboratory balance

Materials

Sample of vegium

Pre-Lab Questions [5]

1. What subatomic particle determines the element?_____
2. What number on the periodic table represents the subatomic particle in question 1? _____
3. What subatomic particle differs between isotopes of the same element?_____
4. When the subatomic particle referred to in question three increases in number in an isotope, what happens to the mass of the isotope? _____

Procedures

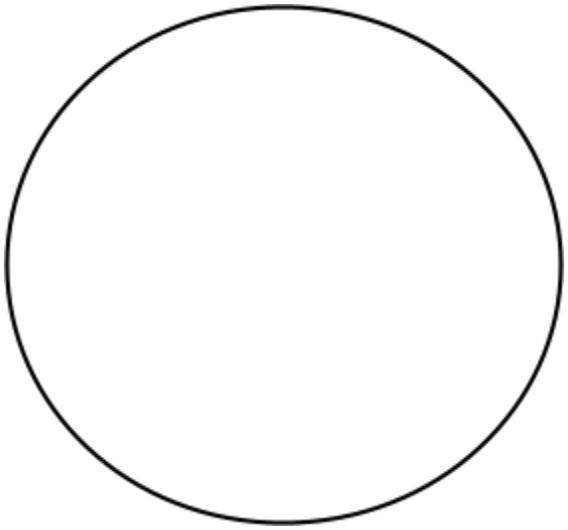
1. Carry out the following steps, and record your results in Table 1.
2. Count all the beans, all the peas, and all the corn. Record in column 2.
3. Add the number of each to determine the total number of atoms in your sample.
4. Separate each isotope. Weigh all the beans, all the peas, and all the corn. Record in column 3.
5. Add the mass of each isotope to determine the total mass of the sample.
6. Divide the total mass of each isotope (from column 3) by the number of each isotope (from column 2) to get the average mass of each isotope. Record in column 4.
7. Divide the #of each isotope (in column 2) by the total number of particles (at the bottom of column 2), and multiply by 100 to get the percent abundance of each isotope.

$$\frac{part}{total} * 100 = percent$$

Observations and Data

Table 1 [5 points]

1. Isotope type	2. # of Atoms of isotope	3. Total mass of each isotope	4. Avg. mass of 1 isotope particle	5. % abundance of isotope
pea				
corn				
lima bean				
Totals				**100%**



Before you return your sample:
Mix your vegium isotopes back together. Pour the vegium on the table again and draw a representation of the amount and size of each particle in the circle. Be sure to label!

Cleaning up
Please place the entire sample of vegium back in the plastic bowl. Make sure that none of the "atoms" are in the sink or on the floor. Thank you!

Calculations - Using the % abundance and average mass of each isotope, calculate the average atomic mass of the fictitious element Vegium. Show your calculations in the box below. [5]

Questions [15]

1. What does a single piece of the sample represent [1]?

2. There are peas (small) and beans (large). How does this relate to the concept of isotopes? Why did I use something small and large? What did it represent at the atomic level [1]?

3. What subatomic particle was present in differing numbers in each fictitious isotope? [1] _____
   a. Which isotope had fewer of this subatomic particle? [1] _____
   b. Which isotope had more of this subatomic particle? [1] _____

4. What is the difference between the atomic number and the atomic mass of an atom? [2]
   Atomic number is -

   Atomic mass is -

5. Can atoms of two different elements have the same atomic number? Explain why or why not. [1]

6. Why can't atomic masses simply be an average of the masses of each isotope, for example, C-12, C-13, and C-14 would average ((12+13+14)/3) to be 13? [1 points]

7. Explain why the difference/variation in atomic weight (how close we were to the actual atomic weight) of the vegium would be smaller if larger sample sizes were used [1].

8. If heaviest isotope (beanium) was more abundant, and the other two isotopes (peaium and cornium) were less abundant, what would happen to the atomic weight of vegium? Why? [1]

9. In real life, scientists cannot count each atom. So, if you know that there are some Amadorium atoms in a box and 10% are Ad-3 and the remaining 90% are Ad-4. Can you show all work and calculate the Average Atomic Mass? Of course you can! Now do it…. Show all work for full credit. [4]