PS Chemistry Name____________________Period_____

Lab…Isotopic Pennies

Background information

Pre-1982 and post-1982 pennies have different compositions. The change in composition occurred because of the rising cost of copper in the early eighties. The federal government decided to mint pennies with zinc on the interior because zinc was less expensive to obtain. The incorporation of zinc in the pennies causes pre-1982 pennies to have a different mass than post-1982 pennies, and consequently a different overall density.

In this laboratory activity, a mixture of these pennies will represent the **naturally occurring mixture of two isotopes** of the imaginary element *"pennium"* with the symbol *"Pe". With the pennies, you will simulate one way that scientists can determine the relative amounts of different isotopes present in a sample of an element.* Isotopes are atoms with the same number of protons but different number of neutrons. For example, carbon-12 and carbon-14 are two isotopes with 6 protons each, but C-12 has 6 neutrons and C-14 has 8 neutrons. These two isotopes have different masses because they have a different number of neutrons. The atomic mass of an element given on the periodic table is the average mass based on the relative abundance of its isotopes.

You will be given a sealed bag containing a mixture of pre-1982 and post-1982 pennies. Your bag could contain any combination of the two "isotopes." Your task is to determine the isotopic composition (number of pre-1982 and number of post-1982) of the element "pennium".

Pre-lab Questions

1. What is an isotope?

2. How are isotopes of the same element similar?

3. How are isotopes of the same element different?

4. What intensive physical property of the element "pennium" distinguishes its pre-1982 and post-1982 forms from each other?

5. What extensive physical property of the element "pennium" distinguishes its pre-1982 and post-1982 forms from each other?

Purpose: To determine the isotopic composition (number of pre-1982 and number of post-1982) of the element "pennium".

Materials

Bag of pennies balance calculator

Procedure

1. Get a bag of pennies from your teacher, record the number of the bag.
2. Sort the pennies by date into two groups: pre-1982 pennies and post-1982 pennies. Count and record the total number of pennies in each group. Record in the Data Table.
3. Use the balance to determine the mass of the pre-1982 and post-1982 pennies by group. Record each mass to the nearest tenth in the Data table.
4. Calculate the average mass of a pre-1982 and a post-1982 penny by dividing the total mass of each group by the number of pennies in that group. Record the average mass in the Data Table. *Show your work here.*

5. Calculate the percentage abundance of each group. To do this, divide the number of pennies in each group by the **total number** of pennies (all of the pennies together regardless of year). Record in the Data Table. *Show your work here.*

6. Using the percentage abundance (found in step 5) of each "pennium" and the average mass (found in step 4) to calculate mass contribution.
   Show your work here.

Mass Contribution = (% Abundance)(Average Mass)

Mass Contribution for Pre-1982 "Pennium"

Mass Contribution for Post-1982 "Pennium"

7. Sum the mass contributions (Pre-1982 and Post-1982) to determine the atomic mass of the "pennium". (This represents the atomic mass of the "Pennium" atom). *Show your work here.*

Data Table

Bag ID #_____

	Pre-1982 Pennies	Post-1982 Pennies
Total Count		
Total Mass		
Average Mass		
% Abundance		

Data Analysis

1. Would the atomic mass be different if you received another bag of pennies containing a different mixture of pre-1982 and post-1982 pennies? Explain.

2. Why is the element "pennium" a good analogy or model for actual element isotopes?

3. Find the average atomic mass of an atom of silver. (Refer to the table below.)

Isotope name	**Isotope mass (amu)**	**percentage**
Silver-107	106.90509	51.86
Silver-109	108.90470	48.14