Isotopes of "Pennium"

Purpose: To determine the number of isotopes of the element "pennium" and determine the element's average atomic mass.

Introduction:
Unless you're a coin collector, you probably think all United States pennies are pretty much the same. To the casual observer, all the pennies in circulation do seem to be identical in size, thickness, and composition. But just as elements have one or more isotopes with different masses, the pennies in circulation have different masses. In this investigation, you are going to use pennies with different masses to represent different "isotopes" of an imaginary element called pennium, or Pe. Remember that chemical isotopes are atoms that have the same number of protons, but different numbers of neutrons. Thus, chemical isotopes have nearly identical chemical properties, but some different physical properties. In this investigation, you will determine the relative abundance of the isotopes of pennium and the masses of each isotope. You will then use this information to determine the atomic mass of pennium. Recall that the atomic mass of an element is the weighted average of the masses of the isotopes of the element. This average is based on both the mass and the relative abundance of each isotope as it occurs in nature.

Pre-Lab Discussion:
1) What do the 20 pennies in this investigation represent?

2) What do the different masses of the pennies represent?

3) What information do you need to calculate the average atomic mass for an element?

Procedure:
1) Remove the pennies from the resealable bag and count them to make sure that there are 20. Determine and record the combined mass of your 20 pennies.
2) Find the mass of each penny separately. In the Data Table, record the year the penny was minted and its mass to the nearest 0.01 g.
3) Place the 20 pennies in the resealable bag and return the pennies to the area designated by your teacher. Clean up your work area and wash your hands before leaving the laboratory.

Observations
Combined mass (to nearest 0.01 g) of 20 pennies _____

Data:

Mass of atom (g)	Year	Mass of atom (g)	Year

Calculations:

1) Inspect your data carefully. Determine the number of isotopes of Pe that are present.

2) Calculate the fractional abundance of each isotope in your sample.

3) Calculate the average atomic mass *of each isotope*.

4) Using the fractional abundance and the average atomic mass of each isotope, calculate the average atomic mass of Pe.

Questions

1) Was the mass of 20 pennies equal to 20 times the mass of one penny? Explain.

2) In what year(s) did the mass of Pe change? How could you tell?

3) Why are the atomic masses for most elements not whole numbers?

4) How are the three isotopes of hydrogen (hydrogen-1, hydrogen-2, and hydrogen-3) alike? How are they different?

5) Copper has two isotopes, copper-63 and copper-65. The relative abundance of copper-63 is 69.1% and copper-65, 30.9%. Calculate the average atomic mass of copper.

Conclusion: