

Name: _____

Block: _____

Isotopes of “Pennium”

Background

In 1982, the US Mint changed the mixture of metals that pennies are made of. Pennies made before 1982 are made of mostly copper, and pennies made after 1982 are mostly zinc. Both kinds were made in 1982, so a 1982 penny could be either one.

| Years | Composition | Mass |
|--------------|---------------------------|-------|
| 1864–1982 | 95% copper; 5% tin & zinc | 3.1 g |
| 1982–present | 97.5% zinc; 2.5% copper | 2.5 g |

In this activity, we will be using pennies to represent atoms of the imaginary element “pennium” (element symbol “Pn”). Each “atom” (penny) is either the heavier isotope ${}^{3.1}\text{Pn}$, or the lighter isotope ${}^{2.5}\text{Pn}$.

Directions

You will be given a sample of “atoms” of pennium. Your job is to determine the average atomic mass of the atoms in your sample, both by calculating, and by direct measurement

Calculated Average Atomic Mass

1. Count the number of pennies in your sample that were minted before 1982 vs. after 1982. If you find a 1982 penny, measure its mass and decide which isotope it is.

atoms ${}^{3.1}\text{Pn}$ (1864–1982): _____ # atoms ${}^{2.5}\text{Pn}$ (1982–present): _____

2. Using the abundance of each isotope and its mass, calculate the average atomic mass of pennium, based on your sample.

Measured Average Atomic Mass

3. Measure the mass of your sample of pennies.

of pennies : _____ mass of pennies (“atoms”) in sample: _____ g

4. Divide the total mass of pennies by the number of pennies to get the average mass of a penny in your sample.

Discussion Questions

1. How do your calculated and measured average atomic masses agree?
2. Was your atomic mass for pennium equal to the mass of either type of penny?
3. If your sample had contained more of the heavier isotope (pennium-3.1), how would this affect your average atomic mass?
4. Suppose the actual abundance of pre-1982 and post-1982 pennies in circulation is equal to the numbers from your sample. How many “atoms” of pennium (pennies) would there be in a 25 kg (25,000 g) jar of pennies?