## ISOTOPIC PENNIES

Purpose: To simulate the percentage of each isotope of a specific element when given the weighted average of all naturally occurring isotopes.

Discussion: The U.S. penny was first issued in 1909 and was composed of $95 \%$ copper and $5 \%$ zinc. All pennies were made with this composition until 1982 when the high cost of copper dictated a major change in composition. Since 1982, U.S. pennies have been produced with $97.6 \%$ zinc with a thin plating of copper. Since each metal has a different density, pre and post 1982 pennies have different masses.

A mixture of pre and post pennies will represent the naturally occurring mixture of two isotopes of an imaginary element. With this mix of pennies, you will simulate one way the scientists can determine the relative amounts of different isotopes present in a sample of an element.

You will be given a sealed balloon with a total of 10 pre and post 1982 pennies. You must determine the number of each type of penny in the container.

## Procedure:

1. Obtain 10 pre-82, 10 post- 82 pennies, one empty balloon, and an unknown balloon of pennies. At no time will you open your unknown balloon
2. Obtain and record the following data:

| Number on Balloon |  |
| :---: | :--- |
| Mass of 10 pre-82 pennies |  |
| Average mass of 1 pre-82 penny |  |
| Mass of 10 post-82 pennies |  |
| Average mass of 1 post-82 penny |  |
| Mass of empty balloon |  |
| Mass of balloon and 10 pennies |  |

Calculation: Use a system of equations to determine the number of pre-82 and post82 pennies in your balloon.

## Isotopic Pennies

## Name

## Pre-lab Questions:

1. What is an isotope?
2. What is the difference in pre and post 1982 pennies?
3. Suppose you have a paper bag containing only pencils and pens. The total number of items is 25 . From the data given below, set up and solve a system of equations to determine the number of pens and pencils in the bag.

| ITEM | MASS |
| :--- | :--- |
| One pencil | 2.00 g |
| One pen | 5.00 g |
| Empty bag | 0.50 g |
| Bag + mixture of pencils and pens | 104.50 g |

4. What percentage of pencils and pens are in the bag?
