Lab 2: Measuring the Density and Finding the Metals of Various Coins

**Goal/Purpose**

Your goal is to find the densities of various coins, and then use that information to determine the main metal component of each coin. You will find the mass by using a scale and the volume by measuring the displacement of water in a graduated cylinder.

**Procedure**

1. Place 50.0 mL of water into a graduated cylinder. Record the initial water level of water as 50.0 mL.
2. Put the cylinder on the balance. Record the initial mass of the cylinder and water.
3. Add 3 of a certain type of coin to the cylinder. Notice that the water level rises. Record the final water level. The volume of the coins can be determined by water displacement (i.e. by taking the difference between the volumes).
4. Put the cylinder on the balance. Record the mass of the cylinder, water and the pennies.
5. Find the mass of the coins by subtraction.
6. Add three more pennies, so that there is a total of 6 coins in the cylinder. Record the volume and the mass.
7. Keep adding the coins, in groups of 3, until you have put all of your available coins into the water.
8. Repeat steps 1-7 for various coin types until you have done at least three (3) different coin types. Note: Pennies from before 1983 and after 1983 count as two different types of coins, so be sure not to mix them!

**Data**

You will need to create a table such as the one below for each of the coins you are testing.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Trial | Mass of cylinder with water and coins (grams) | Mass of cylinder with water (grams) | Mass of coins (grams) | Volume of water and coins (mL) | Initial volume (mL) | Volume of coins (mL) | Density (g/mL) |
| 3 coins |  |  |  |  | 50.0 |  |  |
| 6 coins |  |  |  |  | 50.0 |  |  |
| 9 coins |  |  |  |  | 50.0 |  |  |
| 12 coins |  |  |  |  | 50.0 |  |  |
| 15 coins |  |  |  |  | 50.0 |  |  |

**Analysis**

1. Create a graph for one of your coins graphing volume vs. mass (volume along the x-axis and mass along the y-axis). What do you notice about the shape of the graph? What does the slope represent?
2. Find the average density of each coin you measured.
3. Using the average density, and the table below, give an educated guess as to what types of metals each of the coins are made of.

|  |  |
| --- | --- |
| Metal | g/cm^3 |
| aluminum | 2.7 |
| zinc | 7.13 |
| iron | 7.87 |
| copper | 8.96 |
| silver | 10.49 |
| lead | 11.36 |
| mercury | 13.55 |
| gold | 19.32 |

1. Why do you think the pre-1983 and the post-1983 pennies have different densities? Why might the US government do this?