Penny Density Lab

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Background Information:
Pennies minted before 1982 are composed of 95 percent copper and 5 percent zinc. After 1983, the US Mint changed the composition of the penny to be 97.6 percent zinc and 2.4 percent copper. The newer pennies have a zinc core and are plated with copper on the outside. Because the newer pennies have a different composition from the older pennies, they have a different density. The density of copper is 8.96 g/mL and the density of zinc is 7.13 g/mL.

Sources: http://chemconnections.org/general/chem120/Density-JCE-Pennies-12.pdf, www.rsc.org

Procedure:

Work with one set of pennies at a time.

1. Obtain one set of pennies. Obtain the mass of five pennies. Record this measurement on the appropriate data table.
2. Add five more pennies to the balance and record the total mass of these 10 pennies on the data table.
3. Repeat step two until you have used a total of 20 pennies.
4. Pour approximately 30 mL of water into a graduated cylinder (*this does not need to be exactly 30 mL*). Record the <u>*exact*</u> amount of water that you placed in the cylinder in your table under initial volume. Because you do not add more water, this initial volume does not change for this set of pennies.
5. Using the same group of pennies that you just massed, drop the first five pennies into the graduated cylinder. Record the volume of water after dropping the five pennies in the cylinder. This is your final volume.
6. Add the second group of five pennies to the graduated cylinder and record the new volume. Add them in the same order you weighed them.
7. Repeat these steps until you have used all 20 pennies.
8. Carefully pour the pennies and water out of the cylinder. (Use the sink). *Dry the pennies thoroughly*.
9. Repeat the above steps using the other set of pennies. Record this data on the appropriate data table.

Graph:
Let the **Y** axis represent the *mass* of the pennies, and let the **X** axis represent the *volume* of the pennies. Plot *both* the pre-1983 pennies and the post-1983 pennies on the *same* graph using two different lines. Using a ruler, draw a line of best fit between the points for each line, creating two separate standard curves. Do <u>*NOT*</u> connect the dots! Create a key or label the lines with the proper year of pennies. The 1983 pennies do not belong on this graph.

Data:

Pre 1983 Pennies Data Table

Number of Pennies	Mass (g)	Initial volume of water in mL	Final volume in mL (water + pennies)	Volume of pennies (mL)
5				
10		XX		
15		XX		
20		XX		

Post 1983 Pennies Data Table

Number of Pennies	Mass (g)	Initial volume of water in mL	Final volume in mL (water + pennies)	Volume of pennies (mL)
5				
10		XX		
15		XX		
20		XX		

1983 Pennies Data Table

Number of Pennies	Mass (g)	Initial volume of water in mL	Final volume in mL (water + pennies)	Volume of pennies (mL)
5				

Calculations Required:
Use units at all times!

1. Slope of line of best fit for pre-1983 pennies. Show this work in the calculation section, not on your graph.
2. Slope of line of best fit for post-1983 pennies.
3. Density of 1983 pennies (not found on the graph).

Questions:

1. What does the slope of a line of best fit have to do with density?
2. Is the composition of the 1983 pennies similar to the older (pre) pennies or the younger (post) pennies?
3. What is the benefit of using five pennies at a time instead of just one?
4. Why did you use 20 pennies to determine the density of the pennies? Why bother making the graph?

Conclusion:
Include the following in your conclusion paragraph:

- What do you conclude from your results? Include any applicable information from your questions.
- What could have gone wrong to give you funky numbers? (But don't actually use the term "funky" in your report. Make it sound a little more professional and scientific) Assume that you made no errors in measurement. Think about things you can control and things you can't control. Be specific! DO NOT SAY HUMAN ERROR!!!!
- If you repeated this lab, what would you change?