Experiment 2 Determining the Masses of a Nickel and a Penny

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We calculated the mass and volume of pennies and nickels by measuring the height of a stack of the coins, the diameter of each coin and calculating the density of each coin from the given percentages of the materials that comprise the alloy each coin was made of. The handbook value for each coin landed within the uncertainty for both of the coins.

Results

Discuss whether, or not, the calculated masses for the penny and for the nickel are acceptable. Handbook values are: Penny = 2.5 grams; Nickel = 5.0 grams.

Penny: 2.74 ± 0.25

Nickle: 5.37 ± 0.41

The handbook values for both the penny and nickel fall within the calculated uncertainty, but they both lie closer to the lower end of the uncertainty range. This is likely because the calculations assumed that the coins were cylinders of the alloy while in reality they have a design on them which would lower the material present and therefore the weight.

Questions for Discussion

1. In the Results section above you discussed whether the calculated values are in agreement with the accepted handbook values. If either of these are not in agreement what possible reasons can you give as to why they are not. Refer to the process of how you measured the diameter and the height of the stack and relate it to the equation for the volume of the stack.

They were both in agreement.

1. Use the percent error equation (found in experiment 1) to show how close your calculated values for the mass of the penny and for the mass of the nickel are to the accepted values. Again, use a reasonable maximum % Error when doing the comparisons.

The penny weighed 9.6% more than the handbook value and the nickel weighed 7.4% more than the handbook value. They were both greater than the commonly used maximum % error of 5%.

1. A student wants to increase the number of coins stacked on top of each other to increase the accuracy of determining the volume for one coin. Would this technique work? Consider your answer for question 1 in answering this question.

This technique would not work because that would increase the amount of unfilled space due to the coins not being perfect cylinders of their respective alloys.

1. Devise a different method of measuring the volume of the coins that would result in a more accurate value than measuring a stack of coins.

A more accurate way of measuring the volume of the coins would be through water displacement. This could work by filling a graduated cylinder to a point with water and adding the coins in to see how much the volume changed.