

Penny "Isotopes"

Background Information

In 1997, the Canadian government changed the minting process of pennies.



Old Penny Composition

(1943-1996)

98% copper
1.75% tin
0.25% zinc

New Penny Composition

(1997- present)

94% steel
1.5% nickel
4.5% copper



This resulted in two groups of pennies with different masses. Your task will be to determine the exact number of each type of penny in a random sample of pennies using only a scale!

Pre-Lab Questions:

- What do the two kinds of pennies represent in this exercise?

- How do the pennies differ? How do isotopes differ?

Procedure:

Part A

1. Obtain a sample of ten pennies.
2. Weigh several pre-1997 (old) pennies and record their average mass.
3. Weigh several post-1997 (new) pennies and record their average mass.
4. Calculate the mass of three old pennies plus seven new pennies.
5. Divide your answer by ten to calculate the **weighted average** mass of the pennies in the sample containing three old plus seven new pennies.
6. Weigh your sample of three old and seven new pennies. Record the mass.
7. Divide your answer by ten to find the average mass of a penny in your sample.

Rough work:

Results:

Average mass of old penny	_____ g
Average mass of new penny	_____ g
Calculated weighted average mass (3 old + 7 new)	_____ g
Measured total mass (3 old + 7 new)	_____ g
Measured weighted average mass (3 old + 7 new)	_____ g

Part A Follow-up Questions:

- 1) Compare your calculated weighted average to your measured weighted average..

- 2) Is the weighted average mass closer to the mass of an old penny or a new penny? Why?

- 3) How is the weighted average mass of pennies related to atomic mass?

Part B

1. Obtain a sample containing six old pennies and four new pennies.
2. Using the mass of an old penny and a new penny from Part A, calculate a **weighted average** mass for this sample of pennies. You need to find the mass of all ten pennies and divide by ten to find the weighted average mass.
3. Now weigh your sample of pennies. Record the mass.
4. Divide the mass of your sample of ten pennies by ten to find the actual average mass of a penny in this sample.

Results:	
Calculated weighted average mass (6 old + 4 new)	_____ g
Measured total mass (6 old + 4 new)	_____ g
Measured weighted average mass (6 old + 3 new)	_____ g

Rough work:

Part B Follow-up Questions:

- 1) Compare your calculated weighted average to your measured weighted average.

- 2) Is the weighted average mass closer to the mass of an old penny or a new penny? Why?

Part C – The Mystery Sample

1. Return your sample of ten pennies from part B to your teacher. Obtain a canister with an unknown proportion of pennies. *Don't open it.* Record its identifying number or letter.
2. Measure and record the mass of the empty canister from your teacher.
3. Find the mass of the sealed canister containing ten mixed pennies.
4. Return the canister to your teacher.

Results:	
Canister Letter:	_____
Mass of canister	_____ g
Mass of canister + pennies	_____ g
Mass of pennies	_____ g

Calculate the number of old and new pennies. Show all of your work!

How many old pennies do you have? _____

How many new pennies do you have? _____

What percentage of old and new pennies do you have? Old: ____% New: ____%