

STATION 8


DETERMINE THE MASS OF 6 PENNIES WITH A SCALE. SORT THE PENNIES INTO 2 GROUPS. DETERMINE THE MINTING DATES OF EACH PENNY.

Is there a correlation between the minting date and the mass of the pennies?




Concept and Answers- The Mass of a Penny vs Date.

Mass in the metric system is measured in grams or kilograms. A gram is a small unit compared to units we use in stores and is about 1/28th of an ounce. To give you a feel for the magnitude of a gram, this exercise involves the determination of the mass of some pennies. One gram is a relatively small amount compared to amounts we are used to weighing. Because of this, the balance is considerably more sensitive than balances you have used before. Since the balance has a capacity of less than 0.5 lb, heavy objects should not be placed on the balance.




UNITS OF MEASUREMENT




The most common units of measurement for mass are **grams** and **kilograms**.


A gram is very light. These items weigh approximately 1 gram.



1 pen lid




1 paperclip




1 piece of chewing gum


A kilogram is 1000 grams. These items weigh approximately 1 kilogram.



1 litre of milk



2 loaves of bread



7 apples

The composition of a penny has changed many times but until 1982, has been predominantly copper (except for 1943 and 1974). Since 1982, pennies have been over 97% Zn. Since the density of Zn is 7.13 g/cm^3 and copper's density is 8.96 g/cm^3 and the volume of a penny is 0.35 cm^3 , a copper penny has a mass of about 0.65 grams more than a zinc penny. Thus it should be possible to distinguish pre-1982 pennies from post-1982 pennies by a mass determination of the penny.

years	materials	mass (grams)
1793 - 1857	100% Cu	13.48
1857 - 1864	88% Cu, 12% Ni	10.89
1864 - 1942	bronze - 95% Cu, 5% Cu, Zn	3.11
1943	Zn coated steel	2.67
1944 - 1946	brass - 95% Cu, 5% Zn	varies
1946 - 1962	bronze - 95% Cu, 5% Cu, Zn	varies
1974	experimental Al variety	
1962 -1981	brass - 95% Cu, 5% Zn	3.11
1982	some from above, below	3.11 or 2.5
1982 - present	97.5% Zn, 2.5% Cu plating	2.5

When the mass of a penny is determined to 0.1 g, pre 1982 pennies should have a mass of about 3.1 grams. Post 1982 grams should have a mass of about 2.5 grams. The chart above should enable you to determine if a penny was minted before or after 1982.

Materials and Images. Scales for Stations 8, 9, 11 and 12 are available from Ebay for less than \$25 each.

<http://www.ebay.com/itm/500g-x-0-01g-High-Precision-Digital-Scale-SF-400D2-Counting-w-US-B-Wall-Adapter-/381198858937?hash=item58c138fab9:g:yFcAAOxy3zNSiEoa>



The scale on the right is the same as the scales used in Station 11. The scale on the left was donated by NASCO West and is a decigram scale. The scale on the right could have been used for both applications.

