

## A PENNY'S SECRET

### STANDARDS

See summary of National Science Education Standards.

Original: <http://books.nap.edu/readingroom/books/nse/>

Standard concept	General Standard	Specific Standard	General Standard	Specific Standard	General Standard	Specific Standard
Grade Level		K-4		5-8		9-12
Science as Inquiry (A)	Abilities ... to do ... inquiry	A.1.4.1	Abilities ... to do ... inquiry	A.1.8.1	Abilities ... to do ... inquiry	A.1.12.1
		A.1.4.2		A.1.8.2		A.1.12.2
		A.1.4.3		A.1.8.3		A.1.12.3
		A.1.4.4		A.1.8.4		A.1.12.4
		A.1.4.5		A.1.8.5		A.1.12.5
				A.1.8.6		A.1.12.6
				A.1.8.7		
				A.1.8.8		
	Understandings about ... inquiry	A.2.4.1	Understandings about ... inquiry	A.2.8.1	Understandings about ... inquiry	A.2.12.4
		A.2.4.2		A.2.8.2		
				A.2.8.3		
Physical Science (B)	Properties of ... materials	B.1.4.1	Properties and changes of properties of matter	B.1.8.1	Chemical reactions	B.3.12.1
		B.1.4.2		B.1.8.2		
				B.1.8.3		
Earth and space science (D)	Properties of Earth materials	D.1.4.1				
Science in ... social perspective (F)	Types of resources	F.3.4.1				
		F.3.4.2				



## A PENNY'S SECRET

### INTRODUCTION

Metals mined from the Earth are used to make products. Coins are an old use of metals, still used today. This activity brings to light some factors considered in the manufacture of a penny. When the price of copper rose to over \$1.33 per pound in 1980, the cost of minting a penny became more than its monetary value. What was the mint to do?

### PURPOSE:

To introduce students to the economic factors of the minerals industry that influences the minting of coins.

### MATERIALS REQUIRED:

- At least 10 pennies per student group minted between 1980 and 1985. Make sure you have some 1982 and 1982D.
- Rulers
- 1" x 4" poster board or card stock paper

### ACTIVITY:

- 1) Have students study the various coins to see if they all seem to be the same.
- 2) Fold the poster board in half to form a "V" to act as the fulcrum for the ruler.
  - a) Place the folded card stock on a flat desk with the point of the "V" up to form the fulcrum.
  - b) The ruler is used as the balance to compare the masses of two pennies.
- 3) Balance the ruler on the poster board fulcrum on a level desk so the ruler is parallel to the desk. Note the balance point of the ruler may not be at 6 inches.
- 4) Place a 1984 penny flush with one end of the ruler. Using the ruler as a see-saw, put the other pennies, one at a time, flush with the other end.
  - a) Make two piles of weighed pennies, those heavier than the 1984 and those about the same or less.
    - i) If the other penny makes the end of the ruler on which it was placed drop, put it into one pile. That second penny weighs more than the 1984 one first placed.
    - ii) If the other penny doesn't make the end of the ruler on which it was placed drop, put it into a second pile. That second penny weighs the same or less than the 1984 one first placed on the ruler.

### EVALUATION:

- 1) How are the pennies in each pile the same (within the pile)?
  - a) Look at all the qualities of the pennies:
    - i) Color
    - ii) Pictures and lettering
- 2) How do the two piles of pennies differ from each other (between the piles)?



- 3) If the pennies look alike, how could they differ in mass, as shown by the tilting of the ruler?
- 4) Read the background information below to help answer the question if necessary.

#### BACKGROUND:

The price of copper rose to over \$1.33 per pound in 1980, making the cost of minting a penny more than its monetary value. The U. S. Mint began developing a zinc core penny with a copper coating. The new penny looked identical to the previous coins but it was cheaper to produce. While the new penny was the exact same size as the old one, it weighed less because zinc is slightly less dense than copper. The change from copper to zinc took place in 1982. The mint was also experimenting with the size of the date so there are actually 7 different types of pennies dated 1982. Because coins minted before 1982 contained only copper, the heavy pennies in the exercise will be dated 1980-82. The lighter pennies will be from 1982-85.

#### OPTIONS:

- 1) Have the students experiment with other coins like dimes and quarters.
  - a) Do the old coins weight more or less than the new sandwich type?
- 2) If you have access to a lab room with a fume hood you may want to remove the copper and expose the zinc penny by soaking some new pennies in a little nitric acid. This can also be done outside but must be closely supervised.
  - a) Use dilute nitric acid and remove the coins as soon as you start to see the silver colored zinc because zinc will also dissolve in nitric acid.
- 3) If you don't have access to a hood, you can score through the copper coating and put the penny into a dilute solution of hydrochloric acid, also called muriatic acid at hardware stores.
  - i) Hydrochloric acid will dissolve the zinc, but not the copper, to produce hydrogen gas bubbles. You will be left with a shell of copper metal.
  - ii) To make clear what is happening, dissolve a piece of plain zinc metal in HCl, too.
- 4) For older students, have the students measure the densities of both types of coins.
  - a) Look up the densities of zinc and copper
  - b) Compare the measured densities of the two metals to the densities of the metals.
  - c) If density is measured in g/mL, what is the volume of zinc (and volume of copper) used in the newer coins to make the density of the coin equal the measured density? (use algebra)



- 5) For a cooking activity, related to coins, make Copper Cheese "Coins:"
- a) Materials
    - i) 6 oz. Jar of pasteurized cheese spread
    - ii) 1/4 cup butter flavored shortening
    - iii) 2/3 cup flour.
  - iv) Procedure
    - (1) Mix all ingredients together and on wax paper roll into a long log, about one inch in diameter.
    - (2) Refrigerate for 2 hours.
    - (3) Slice dough 1/2" thick and place on ungreased cookie sheet.
    - (4) You might want to sterilize some coins and make imprints in the dough before baking.
    - (5) Bake at 375° F for 12 to 15 minutes.

