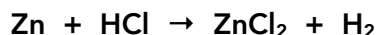


Lab: A Penny's Worth of Zinc

Introduction & Background:

In 1983 the U.S. Treasury began minting pennies composed of a zinc core covered with copper. In this experiment, you will remove the zinc from a penny by reacting the penny with hydrochloric acid in a single replacement reaction (*unbalanced*):



In this lab, you will determine the percent of copper and zinc in the penny and learn about the economics of 'why' copper was replaced with zinc.

Purpose: To observe a single replacement reaction.

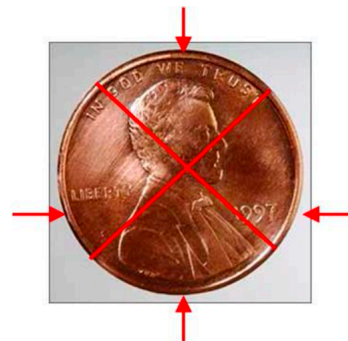
Safety:

- Wear goggles and aprons
- 3M HCl is corrosive - avoid skin contact
- If you spill any acid on your skin, immediately wash it off with a lot of water.

Procedure:

DAY 1

1. Using a file etch an "X" on one side of the penny. Also etch a notch on the edge in the four positions shown in the diagram.
2. Place the penny on the electronic balance and record the mass of the penny (in grams) in a data table in your notebooks.
3. Use your phone to take a picture of your penny.
4. In a 100 mL beaker (or what is available) pour approximately 50 mL of 3 M HCl. (The beakers may already be filled for you.)
5. Mark your beaker (use a piece of paper or tape to label your beaker).
6. Place the penny in the beaker etched side up.
7. Place a watch glass over the top of the beaker to prevent bubbling/splashing of the HCl.
8. Observe the reaction. Record your observations in your data table.



DAY 2

1. Half fill a second beaker (100 mL or 200 mL) with water.
2. Using forceps, remove the penny from the beaker and place it in the water beaker.
3. Carefully pour the beaker containing the acid down the drain while running the faucet.
4. Lay penny on a paper towel to get the majority of water off of the penny.
5. Put your name on the paper towel and place it in the lab somewhere that you can find it the next day.

DAY 3

1. Find your penny and measure the mass of the penny using the balance (in grams), record the mass in your data table.

Name: _____

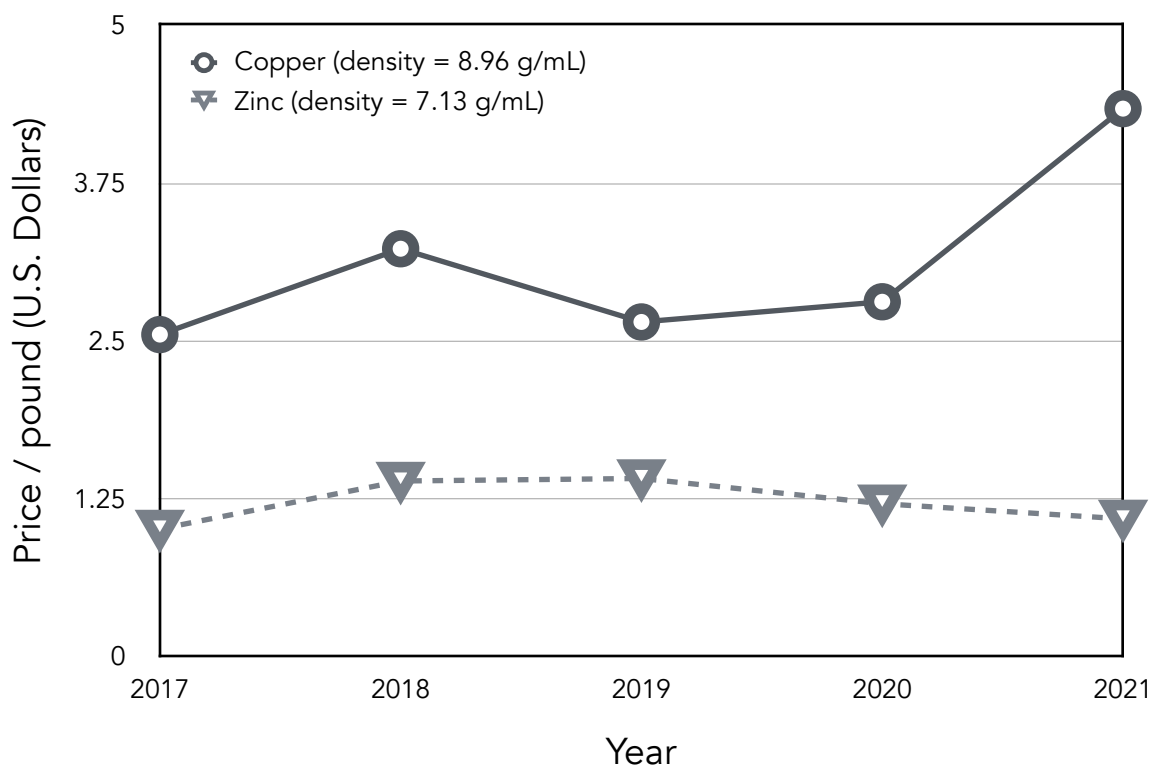
Date: _____

Data Table: Year of Penny, Mass of Filed Penny, Mass of Penny after Acid has etched out the zinc. You should also record observations for your initial penny, the reaction with HCl and the appearance of your penny after the reaction.

The Composition of the Cent

Following is a brief chronology of the metal composition of the cent coin (penny).

- The composition was pure copper from 1793 to 1837.
- From 1837 to 1857, the cent was made of bronze (95 percent copper, and five percent tin and zinc).
- From 1857, the cent was 88 percent copper and 12 percent nickel, giving the coin a whitish appearance.
- The cent was again bronze (95 percent copper, and five percent tin and zinc) from 1864 to 1962. (Note: In 1943, the coin's composition was changed to zinc-coated steel. This change was only for the year 1943 and was due to the critical use of copper for the war effort. However, a limited number of copper pennies were minted that year.)
- In 1962, the cent's tin content, which was quite small, was removed. That made the metal composition of the cent 95 percent copper and 5 percent zinc.
- The alloy remained 95 percent copper and 5 percent zinc until 1982, when the composition was changed to 97.5 percent zinc and 2.5 percent copper (copper-plated zinc). Cents of both compositions appeared in that year.



Name: _____

Date: _____

Conclusions: You may be typing all of this up in a Google Doc for submission. Use this page for your notes.

- List three indications of a chemical reaction you observed in this lab.
 - _____
 - _____
 - _____
- What is the percent of copper in your penny? Of zinc?
- What is the balanced equation for the displacement of zinc?
- Pennies minted before 1982 contain 2.95 grams of copper. If the cost of copper were \$0.00683/gram, what would be the cost, in cents, to make one copper penny?
- Pennies minted after 1983 contain less copper. If the cost of copper were \$0.00683/gram, what would be the cost, in cents, to make one copper penny, based on the mass of copper found in your data?
- Pennies minted after 1983 contain 2.44 grams of zinc. If the cost of zinc were \$0.00139/gram what would be the cost, in cents, to make one zinc penny?
- Based on your answers to questions #3, #4, and #5 why do you think the U.S. Treasury began using zinc in the core of the penny instead of copper?
- The volume of a penny is (0.360 cm³). Use the Density Equation to determine the mass of a penny if it were made of copper.