

The Penny Factory

4th Grade

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References:

- “Matter, Physical and Chemical Changes” lesson plan from 4th grade curriculum guide

Benchmarks:

PS-1, PS-2, PS-3 & PS-4 (Benchmark A & B): Identify characteristics of a simple physical and chemical change. Describe objects by the properties of the materials from which they are made and that these properties can be used to separate or sort a group of objects. Explain that matter has different states and that each state has distinct physical properties. SI-3, 4, 5, 6 (Benchmark C): Develop, design, and safely conduct scientific investigations and communicate the results. SWK-3 (Benchmark B): Explain discrepancies in an investigation using evidence to support findings.

Objectives:

This lesson allows the students to experiment with chemical changes by mixing a weak acid and base, resulting in the formation of gas bubbles. The students will determine what part of the reaction is a chemical change and a physical change. Students will record their observations and use the data to analyze and interpret the reaction.

Materials:

(Materials are per 4-6 students)

- 5 Clear cups or beakers (labeled 1-5)
- 5 Copper pennies (Older pennies have more copper, before 1982)
- 1 tsp. Salt
- 1 tsp. Vinegar
- 1 Popsicle stick
- 50mL Graduated Cylinder
- Safety goggles
- Student lab sheet (**Found in Student Journal**)

Initial Demonstration:

Place a photograph of a statue on the board or overhead that has green-colored copper oxide. Ask the students to respond in their journal or on paper about how they think the green oxidation occurred. The statue that students will be most familiar with is the Statue of Liberty. Be sure to explain to them that when the statue was brought over from France that it looked like a shiny penny, but over time and exposure to acid rain,

water, oxygen and sea salt, it has slowly turned into the color we observe today. A picture to accompany the original statue would be helpful if one could be located.

Target Observations:

- There is quite a difference in the green color we see now compared to the color of a shiny new penny.
- There are only a few spots on the statue where the original copper can be observed.

Target Model:

- A chemical change requires the interaction between two substances, where at least one new substance is formed. The new substance has chemical properties and it is difficult to reverse the change. Several clues indicate a chemical change, including: color changes, release of heat or light, and the formation of a gas.

Procedure:

Per group of students, have them collect all the materials needed, as listed above in the materials section. Each student should be wearing their safety goggles during this experiment to prevent any splashing to the eyes. They will label the five containers with the following descriptions:

1. Salt and Water
2. Salt and Vinegar
3. Vinegar
4. Water
5. Penny

Next, the students are to place a penny in each container. In containers 1 and 2, sprinkle $\frac{1}{2}$ teaspoon of salt on the penny. Into containers 2 and 3, pour 10mL of vinegar. Into containers 1 and 4, pour 10mL of water. The amount of liquid may need to be adjusted depending on the size of the containers, as the pennies should just be covered. The penny in container 5 will act as the control. Using a popsicle stick, the students should thoroughly mix the two containers containing salt to ensure that most of the salt dissolves. Once all of the solutions have been prepared, this experiment should be left until all of the water has evaporated.

Once the solutions have evaporated, have the students observe the pennies and any changes that have taken place. Their observations should be recorded on the handout accompanying this experiment. They should also draw and color the appearance of the pennies after they have reacted. Follow up the experiment with a discussion about the types of physical and chemical changes that have taken place. Also emphasize why it is important to follow directions for each container so that the variables remain the same for each group so that it is a fair experiment. The class should also discuss any results that turned out differently and if the conditions were kept the same in those experiments.

Target Observations:

- Large salt crystal were left behind in container 1
- In container 2, the salt crystals were blue/green, as well as the penny
- The vinegar caused a small amount of oxidation on the penny, turning it blue/green
- Containers 4 and 5 remained the same, as no reaction was observed

Summary:

This experiment reinforces students to chemical changes. They observe both chemical and physical changes between dissolving and oxidation. As copper mixes with oxygen in the presence of water, salt, and acid, a new substance is formed, causing it to change colors. This green color is what accounts for the color of one of our nation's landmarks, the Statue of Liberty.