Chemist: Copper Cleanup

Time: 45 Minutes **Skill Level:** Elementary (age 6-11)

Background

What is Science Inquiry?
Children are natural scientists. From a very early age they explore the world, ask questions and seek answers. This journey of exploration and discovery is Science Inquiry. Science Inquiry helps young people understand their environment, solve problems and gain knowledge about scientific ideas and processes.

Next Generation Science Standards (NGSS)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
1. Asking questions **3.** Planning and carrying out investigations	**PS1:** Matter and its interactions	**2.** Cause and effect: Mechanism and explanation

Objective
In this activity, students will observe several different chemical reactions.

About the Scientist
Chemists are scientists that study the composition and properties of matter, and the way chemicals interact with each other. Some chemists study substances at the atomic and molecular levels. They often work in laboratories and use their knowledge to identify unknown substances, as well as develop new products or improve existing products.

The Science of Chemical Reactions
A chemical reaction occurs when a chemical substance changes into another substance with a different chemical identity. One type of chemical reaction is *oxidation*, where a material reacts to the presence of air (oxygen). As an example, copper reacts with oxygen over time to produce copper oxide. Students may have observed this on dull pennies—the dull coating is *copper oxide*, the result of the chemical reaction.

A second type of chemical reaction occurs between chemicals with different *pH values*, namely *acids* and *bases*. This type of chemical reaction is called an acid-base reaction. Students may have observed such a reaction between vinegar and baking soda. What liquids react with dull pennies?

Hood River County Curriculum Kits

Materials List:

Dull pennies	Household cleaner with ammonia
Cups	Ketchup
Spoons	pH paper
Vinegar	Markers
Cola	Paper towels
Lemon juice	Water
Baking soda	

Discuss …Ask students what they know about pennies. What are they made of? How do we know? What's different about a dull penny than a shiny one? Discuss how pennies oxidize. How can we remove the copper oxide? Which of these substances is the best penny polisher? Why?

Predict …Generate Ideas. Select a Solution.

Experience "What to Do"- What is the plan for the investigation?
Have each group of students set up a testing station with pH paper, a water cup for rinsing, paper towels, and cups of the following substances:

1. Vinegar
2. Lemon juice
3. Ammonia-based cleaner
4. Cola
5. Ketchup
6. Baking soda and water (students will make a paste)

Give each student seven pennies (one will be a control). Have students add their pennies to the substances before measuring the pH, since the chemical reactions may take a few minutes. These steps are outlined in the student worksheet. Emphasize that students should record their findings in the table after each step.

Share …Encourage students to discuss their observations as they test each substance.

Reflect …**Analyze and interpret the data and results. Discuss among the group.**
Which substance(s) cleaned pennies the best? Why? Did these substances have anything in common?

Generalize …**to real world examples. Construct explanations.** Why did some substances react with the pennies whereas others did not?

Apply …**outside the classroom or club meeting.**
What are some examples of chemical reactions or oxidation that you've observed (e.g., iron rust, silver tarnish, etc.)?

Additional resources:
- This experiment is based on an activity by Fetch! With Ruff Ruffman for PBS Kids:
  http://www.pbs.org/parents/fetch/activities/act/act-coppercleanup.html

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