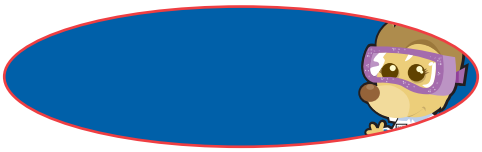
Polishing Pennies

Pennies are made from bright, shiny copper, but they don't stay bright forever, because the copper reacts slowly with oxygen from the air to create a coating of copper oxides. The copper oxides are dull and dark. What is the best way to make pennies shine like new again?

Materials

Masking tape
Pen
6 Small disposable plastic cups (3 oz.)
5 Old, dull pennies
Water
Dilute liquid dishwashing detergent
(¼ teaspoon detergent in 1 cup of water)
Disposable plastic spoon
Lemon juice
Cola
Vinegar
Paper towels
Clock or timer



SAFETY! *SAFETY: Be sure to follow Milli's Safety Tips and do this activity with an adult! Do not drink any of the liquid samples in this activity. Eye protection must be worn by everyone performing this activity.*

Procedure

1. Use the masking tape and pen to label the cups: "lemon juice", "cola", "detergent", "vinegar", and "water".
2. Place a penny in each of the cups, and describe each in the "What Did You Observe?" table.
3. Pour enough water, lemon juice, cola, vinegar, and detergent into the labeled cups so that each penny is completely covered.
4. Wait 3 to 5 minutes.
5. Use a plastic spoon to remove the penny from the "lemon juice" cup and observe how it looks. Write your observations in the"What Did You Observe?" table in the box under "lemon juice".
6. Polish the penny with a paper towel. Observe what happens and write your observation in the table. Look at the paper towel. What color is the material that you rubbed off?
7. Place the penny on the work surface in front of the cup from which it was removed.
8. Repeat steps 6–8 for each of the pennies in the other liquids, and record your observations in the table.
9. Wait about 5 minutes after all pennies are out of their solutions and observe them again. Write down your observations in the table.
10. Thoroughly clean the work area and wash your hands. Rinse the pennies with water, and dry them. Pour all liquids down the drain, and place the other materials in the trash.

Try This..

Conduct your experiment again, using vinegar mixed with a few shakes of table salt. Also, try vinegar with a pinch of cream of tartar, a pinch of table salt, and a drop of dishwashing detergent. See if tomato ketchup or a water solution of baking soda is a good penny cleaner.

As you try these different cleaners, be certain that you continue to follow the safety guidelines, and that your adult partner approves.

Where's the Chemistry?

Not all liquids are the same. In this case, the liquids that were acidic were better cleaners than the ones that were not. Lemon juice contains citric acid, cola contains phosphoric acid, and vinegar contains acetic acid. The detergent and the water are not acidic at all.

The acids in the lemon juice, the cola, and the vinegar react with the copper underneath the oxides on the outside of the penny to form new materials. These newly formed materials dissolve in the liquid and are washed away. So, what is left behind is a very thin coating of copper oxides that you can easily rub away. Did you notice whether any of the solutions changed colors?

What Did You Observe?

Penny	Lemon Juice	Cola	Detergent	Vinegar	Water
Before putting into liquid					
When removed from liquid					
After rubbing on paper towel					
After 5 minutes					

The American Chemical Society develops materials for elementary school age children to spark their interest in science and teach developmentally appropriate chemistry concepts. The *Activities for Children* collection includes hands-on activities, articles, puzzles, and games on topics related to children's everyday experiences.

The collection can be used to supplement the science curriculum, celebrate National Chemistry Week, develop Chemists Celebrate Earth Day events, invite children to give science a try at a large event, or to explore just for fun at home.

Find more activities, articles, puzzles and games at www.acs.org/kids.

Safety Tips

This activity is intended for elementary school children under the direct supervision of an adult. The American Chemical Society cannot be responsible for any accidents or injuries that may result from conducting the activities without proper supervision, from not specifically following directions, or from ignoring the cautions contained in the text.

Always:

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Wear eye protection.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Use all materials carefully, following the directions given.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

Never eat or drink while conducting an experiment, and be careful to keep all of the materials used away from your mouth, nose, and eyes!

Never experiment on your own!

For more detailed information on safety go to www.acs.org/education and click on "Safety Guidelines".