

# Cleaning Pennies

**Estimated Time: 45 minutes**

## SUMMARY

One sign of chemical change is a change in color. In this experiment, you'll see a change in some everyday items. This experiment shows how chemistry exists everywhere and lets students try chemistry at home.

## WHAT YOU'LL LEARN

- Pennies react with oxygen to create a dark layer which can be removed with a reaction involving acid and salt.

### Materials Used per Student

- Spoon
- Paper towel (extras optional)
- Old penny
- 5 mL (about  $\frac{1}{4}$  Tb) table salt
- 15 mL (about  $\frac{3}{4}$  Tb) white vinegar

### Resources Used

- [Can Ketchup Clean a Penny?](#) (for kids)
- [Redox Reactions](#) (for educators)

**Wait to watch the kids video until *after* you do the experiment.**

## WHAT TO DO

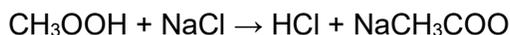
1. Have the students make some observations about their penny. Each student records their thoughts in their own way: maybe they draw a picture, maybe they list some words, or maybe they write a detailed description. It is important that they gather observations in a way that they're comfortable with and they can share.
2. Have the students predict what will happen when the penny is placed in the dry salt. Record their predictions on paper or a whiteboard, then place the penny in the salt. What happened? Record their observations near their predictions.
3. Follow the same procedure from Step 2 with the vinegar. What happened this time?
4. Take out the penny and dry it off. Add the salt to the vinegar and mix until it dissolves as much as possible.
5. Repeat Step 2 again with the salt-vinegar mixture. What happened this time?
6. Wait a short while, then remove the penny and dry it off. Have students make observations again using their preferred method before discussing. How has the penny changed and why?
7. If time and materials permit, try other liquids as shown in the "Can Ketchup Clean a Penny?" video to see if students are better predictors now. Compare the results to find the best cleaner.

### TIPS

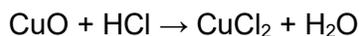
- This reaction is an example of a “redox” reaction (reduction and oxidation). If it’s been a while since you took chemistry, the [“Redox Reactions”](#) video in the Resources Used section is very helpful. As the copper outside of pennies gets older it reacts with oxygen to make copper oxide. Chemists write this sort of reaction like this...



The copper oxide (CuO) is the dark layer on the outside of the old pennies. You can run it off with your hand or a metal scraper but as long as there’s oxygen it will just reform. In this experiment, we reverse the reaction by using the acetic acid in vinegar (CH<sub>3</sub>OOH) and ordinary, sodium chloride table salt (NaCl). When we mix these together, the chlorine from the salt combines with some hydrogen from the acetic acid to create hydrochloric acid (just a little!) and something called sodium acetate. Chemists write that reaction like this...



While copper oxide is perfectly happy on its own, when there’s a strong acid like hydrochloric acid around, the copper ditches the oxygen to make copper chloride and the oxygen and hydrogen combine to make water. Chemists write that reaction like this...



This means we’re not *actually* reversing the whole reaction from before and getting pure copper again, but we’re getting copper chloride which is at least shiny!

- While copper chloride isn’t harmful, rinse the pennies off in water when you remove them from the salt-vinegar mixture to prevent the reaction from continuing out of control.