California State University of Bakersfield, Department of Chemistry

Copper Coated Nail

Standards:

5-PS1-4. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

Introduction:

In this experiment we will use white vinegar and pennies to coat a steel nail with copper. The copper that coats the nail/screw comes from the pennies. However, it exists in the salt/vinegar solution as positively charged copper ions as opposed to neutral copper metal. Nails and screws are made of steel, an alloy primarily composed of iron. The salt/vinegar solution dissolves some of the iron and its oxides on the surface of the nail, leaving a negative charge on the surface of the nail. Opposite charges attract, but the copper ions are more strongly attracted to the nail than the iron ions, so a copper coating forms on the nail.

Materials:

- ¼ cup vinegar
- 1 tsp. salt
- Clear glass bowl
- 25 pennies made before 1985
- 2 steel nails
- Paper towel

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Safety:

- Always have an adult with you to help you during your experiment.
- Always wear eye protection and gloves when doing chemistry experiments
- Additional safety info for your experiment, if any

Procedure:

1. Measure out ¼ cup white vinegar and put it into the glass bowl
2. Add 1 tsp. salt and stir until it is dissolved
3. Take a penny and submerge it into the vinegar solution ½ way for 10 seconds
4. Remove penny and observe.
5. Put all the pennies into the bowl and let them sit in the white vinegar solution for 5-10 minutes
6. Take pennies out and put them onto a paper towel
7. Put one steel nail into the bowl and let it sit all the way on the bottom fully submerged. Take another steel nail and lean it up against the bowl so it is ½ submerged in the solution. Let nails sit for 15-20 minutes
8. After 15-20 minutes take the nails out and observe. If no copper coating is observed, return the nails to the solution. Nails can be left overnight.

Data and Observations:

Record your observations in this space

Questions:

1. What happened to the pennies after they were removed from the solution?

2. How long did the nails soak before you noticed copper coating?

3. Observe the coated nails the next day- were there any changes?

References:

1. Chemistry Fun with Pennies. (n.d.). *About.com Chemistry*. Retrieved August 4, 2014, from http://chemistry.about.com/cs/demonstrations/a/aa022204a.htm.

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