Alchemist’s Dream

Background:

Metallic elements silver (Ag), gold (Au) and copper (Cu) are lustrous, malleable, ductile and conductive. For hundreds of years, each has been used to make sculptures, jewelry and structures.  
  
Artists often work with alloys like bronze, steel or brass because of their durability and color. Bronze is a mixture of copper and tin; brass, made in the activity below, is a mixture of zinc and copper. Steel is made of iron and carbon. Alloys are used to make coins, jewelry, sculptures and other items.   
  
When exposed, metals can become damaged. Why did the Statue of Liberty, a copper structure, turn blue-green? After many years of exposure to humidity and the sulfur compounds in acid rain, copper in the statue oxidized to form copper compounds that are blue-green in color. You may also see this on copper roofs and pennies. This same process of oxidation similarly affects silver. Sulfur-containing compounds found in food or the atmosphere cause silver to oxidize and tarnish.

The alchemists tried very hard to base metals into silver and gold. They also sought to create the “philosopher’s stone,” which was supposed to make a man immortal. Neither of these things actually worked, but it appeared to have worked, as you will see in this lab!

Hazards:

* NaOH is a strong base and is caustic so gloves, goggles, a lab apron, and closed-toe shoes must be worn.
* This should be done under a fume hood to prevent the harmful vapors from escaping into the classroom.

Procedure:

~20 mL of 6 M NaOH

0.1 g zinc dust

50 or 100 mL Erlenmeyer flask

Hot plate

Tongs

200 mL beaker of water

Pennies

1. Mix the NaOH and zinc dust together in the Erlenmeyer flask.
2. Place this solution on the hot plate, and bring to a boil.
3. Once the solution is boiling, add the pennies.
4. Leave the pennies in the solution for about 1 minute.
5. Using the tongs, remove the pennies from the solution, and place them directly into the beaker of water for about 10 seconds.
6. Using tongs, take the pennies out of the water (make sure the zinc dust is off of the penny before removing the pennies), and place them directly onto the hot plate.
7. When the pennies turn a gold color, take them off the hot plate and put them on the workbench to cool.

DON’T FORGET TO LEAVE A FEW PENNIES SILVER!

Chemistry Involved:

When the pennies are added to the beaker of NaOH and Zn dust, the Zn metal is atomized by the NaOH. The Zn atoms then coat the penny, giving it a silver look. The penny must then be washed to get all of the NaOH off the penny. After the coin is rinsed, it must be heated. The heat causes the Zn and Cu atoms to mix, forming brass. The brass gives the pennies a gold look.

Lesson Implementation:

This will be a perfect aid to use when teaching about metal alloys. The silver color on the pennies is actually caused by the formation of brass, a metal alloy.

References:

Published and Online

1. <http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=7&ved=0CF8QFjAG&url=http%3A%2F%2Fweb.fuhsd.org%2Fkavita_gupta%2Fwebsite%2520chemH%2FGold%2520Penny%2520Lab-Gupta.doc&ei=IOEVUMXdK8a20QWor4GwCw&usg=AFQjCNFZUWfD3vOxfCIRBJ4y_H1Bpa_m2Q&sig2=21-MzZZtZb6ihTSUcaODXw>
2. Gross, G.R., Bilash, B., Koob, J. K. (1995). *A Demo a Day: A Year of Chemical Demonstrations.* Batavia, Illinois: FLINN SCIENTIFIC, INC.
3. [www.wikipedia.com](http://www.wikipedia.com)

Videos

1. <http://www.youtube.com/watch?v=MceTmebQuog>
2. <http://www.youtube.com/watch?v=d9mfy5WL2qo&feature=related>