

## Lab 7- Golden Penny

### **Brief Description of Activity:**

The lesson uses in depth laboratory procedure to familiarize students with the operations of a laboratory as well as an activity to help students learn about physical properties of elements and the visual manifestations of physical changes. This is done by having students turning a copper-colored penny to a gold-colored penny by heating a penny in a zinc-NaOH solution and then heating the penny under a bunsen burner.

### **Key Concepts and Definitions of Terms:**

**Physical Property:** a property (as color, hardness, boiling point) of matter not involving in its manifestation a chemical change

**Physical Change:** changes affecting the form of a chemical substance, but not its chemical composition. Physical changes are used to separate mixtures into their component compounds, but can not usually be used to separate compounds into chemical elements or simpler compounds

**Alloy:** A material made of two or more metals, or of a metal and another material. For example, brass is an alloy of copper and zinc; steel is an alloy of iron and carbon.

**Brass:** a metal alloy made of copper and zinc; the proportions of zinc and copper can be varied to create a range of brasses with varying properties. It is a substitutional alloy: atoms of the two constituents may replace each other within the same crystal structure.

**Chemical Property:** the chemical identity of a substance that becomes evident during or after a chemical reaction that results in the change of the substance's identity.

**Chemical Change:** any change that results in the formation of new chemical substances. At the molecular level, chemical changes involve making or breaking of bonds between atoms.

### **What Happens and Why:**

When a copper penny is heated in a solution of sodium hydroxide mixed with zinc dust, small amounts of zinc dissolve into the surface of the penny. This causes the penny to look silver since there is now a layer of zinc over the outside of the penny.

When the silver-colored penny is heated, the outside zinc atoms and inside copper atoms move around because of the heat excitement. This makes the outer layer of zinc mix with the copper below, which becomes an alloy called yellow brass. In this new alloy the copper is lightened by the presence of zinc, making it appear a gold color.

Brass is formed physically. The two metals, zinc and copper, do not react chemically. They use metallic bonding. Both metals want to get rid of electrons to become more stable. The new alloy is a mixture of varying composition of zinc and copper atoms.

### **Materials Needed:**

1. Copper penny (made before 1982) (one student)
2. 0.1 g zinc dust (per penny) (0.2 for 2 pennies, 0.3 for 3 pennies, ect)
3. 20 mL of NaOH
4. 2 beakers
5. Hot plate
6. Electronic Balance
7. Tongs
8. Bunsen burner
9. Sparker to light bunsen burner
10. Source of gas
11. Paper towel

**Safety Information:**

- Sodium hydroxide (NaOH) is corrosive to skin and eyes. Wear gloves when handling. Additionally, NaOH when heated can cause irritation to the respiratory tract. Only heat under a hood in a lab.
- Flame from bunsen burner can cause serious injury. Be careful when handling.

**Procedures:**

1. Wear safety goggles from the beginning
2. Gather materials. Students bring shiny pennies from home.
3. Measure 0.1 g (per student) of zinc using an electric balance (0.2 for 2 students, 0.3 for 3 students, ect).
4. Mix zinc with 20 mL of NaOH in a 200 mL beaker
5. Place beaker on hot plate turned to level 6 and heat mixture (for approx. 5 mins. but not until the solution is boiling)
6. Add pennies to the heated solution and keep on hot plate until penny turns a silver color (approx. 3-4 mins.) (Note: mix about every minute so that the zinc dust covers all parts of every penny).
7. Attach the bunsen burner to the gas source with a tube.
8. Turn the gas source on.
9. Use the sparker or match to start a flame.
10. Adjust the bunsen burner to get a strong, blue flame.
11. Remove penny with clean tongs.
12. Rinse the penny under the faucet with water.
13. Dry both the penny and the tongs with a paper towel to prevent the water to cause burn marks on the penny.
14. Hold the penny in the flame of the bunsen burner using tongs until penny turns a gold color.
15. Hold the penny under running water to cool both the penny and the tongs so that they are safe to touch.
16. Repeat steps 7-11 with the remaining pennies.
17. Clean-up.
18. Show your teacher a copper, “silver” and “gold” penny before the end of class.

**Reflection**

In your journal write a paragraph explaining what happened to the penny during the various stages of the experiment that turned it “silver” and “gold”. Try to incorporate as many of the vocab terms as you can so I know you know them.

