**Student Guide**

## Copper & Corrosion Activity

**Introduction:**
Over time, copper and copper alloys corrode in outdoor environments. Outdoor sculpture and architectural details made of copper or copper alloys can develop a patina of corrosion. This patina is sometimes considered attractive and desirable. But corrosion can also be damaging, destroying the surface and eventually the object as well as staining adjacent materials. This colorful mixture of compounds may have several components including copper oxides such as copper acetate. Historically, colored corrosion products have been used as pigments in paint.

**Objectives:**

- Examine the way copper corrodes and its effects on other materials
- Synthesize an unknown pigment
- Identify the pigment using physical and chemical properties
- Write a balanced chemical equation for the formation of copper acetate

**Supplies (Per Group):**

penny or scrap of copper metal
Large beaker (300 mL)
Small beaker (100 mL)
100 mL Graduated cylinder
Scoopula
Watch glass that will fit over the 300mL beaker
Small dish or container
Scalpel
Glass stirring rod
Balance
Weighing boat
Sodium chloride (NaCl)
Acetic acid ($CH_3COOH$), 5%

**Safety:** Use caution when handling acid. Wear gloves and goggles.

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**Procedures:**

**Part I: Corroding the copper**

1. Obtain a penny or copper sample.
2. Measure 50 mL of the dilute acetic acid. Pour it into the 300 mL beaker. Measure 5 grams of sodium chloride and mix into the acetic acid.
3. Place your penny into the smaller beaker. Multiple pennies may be placed in one beaker provided that they do not overlap (3 will fit comfortably in a 100 mL beaker).
4. Gently place the smaller beaker containing the pennies into the larger beaker of acetic acid. Cover the larger beaker with a watch glass. You now have a small chamber where the acetic acid fumes will corrode the pennies.
5. Leave the chamber undisturbed for at least one week. Observe changes. Allowing the copper objects to be exposed for longer will produce more corrosion.

**Part II: Observing the product**

1. Using tweezers, retrieve a penny from the acetic acid chamber.
2. Observe the appearance of the corroded surface.
3. Write a balanced chemical equation for the reaction of solid copper and acetic acid.
4. *Optional:* Remove the corrosion product by gently scraping with a scalpel. Press lightly and move the blade parallel with the surface to remove the corrosion without disturbing the copper beneath it. Collect the corrosion product on a piece of filter paper and transfer the powder to a container. This corrosion product has historically been used as a pigment and can be identified through the Pigments Activity.

**Clean up:**

- Pennies can be reused multiple times and should be returned to the instructor.
- Properly dispose of acid from the chamber.

Student Name_____ Date_____ Period_____

**Copper Corrosion**
**Answer Sheet**

Note the date of your penny: _____

Observe and describe the surface of your penny before and during acid exposure. (Note observation as frequently as lab sessions allow)

| Day | Observations – color, texture, ability to see image, etc. |
|---|---|
| Ex. 1 | My penny is pink, shiny, smooth, and Lincoln's hair is clearly visible. |
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Write a balanced chemical equation for the reaction of solid copper and acetic acid.

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Analysis Questions

1. Compare your penny with others in the class. Some pennies will have corroded more than others; is there a correlation to the date of the penny? Why might this be so?

2. Where did the copper in the corrosion product come from? If this corrosion reaction were allowed to continue, what would happen to the penny?