

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

**Title:** Metal, Nonmetal, or Metalloid?

**Purpose:** To investigate physical and chemical properties of elements in order to classify them as metals, nonmetals, and metalloids.

**Safety:** Wear safety goggles and aprons.  
Use extreme caution when using acid. Hydrochloric acid (HCl) can attack skin if in contact with skin for an extended time. If acid is spilled on skin, rinse the affected area with water for several minutes, and notify the teacher. HCl spilled on the lab table can be neutralized with baking soda or diluted with water.  
Move around the classroom and lab with caution. No rough behavior allowed.

<b>Materials:</b>	Labeled element samples	Plastic pipettes
	Hydrochloric acid	Waste beakers
	Copper (II) chloride solution	Conductivity testers
	Well plates	Hammer/mallet
	Plastic weigh boats	Paper towels

**Hypothesis:** Based solely on your initial observations of the element samples, predict which samples will be metals, nonmetals, and metalloids. Write the letters of the samples in the appropriate space below.

Metals: \_\_\_\_\_ Nonmetals: \_\_\_\_\_ Metalloids: \_\_\_\_\_

### Procedures:

Read the directions carefully and record your detailed observations in the data table. Do not use the data table to obtain your procedure!

#### A. Physical Properties

1. Appearance. Observe and record the appearance of each element. Include observations about color and luster.
2. Malleability. Follow the instructions at the Testing Station for each sample to decide whether the samples are malleable or brittle. Record in data table.
3. Conductivity. Test the electrical conductivity of the samples using the conductivity testers. With the sample in the plastic weigh boat, touch both electrodes to the sample.
  - Nonconductors: *the bulbs fail to light*
  - Strong conductors: *both the red and green bulbs light*
  - Weak conductors: *only the red bulb lights*

#### B. Chemical Properties

1. Test with hydrochloric acid (HCl) – *Most metals will react with HCl.*
  - a. Place a small amount of each element sample in its appropriate well in the well plate. Use **one piece** of the sample for wire or ribbon and a **few grains** for other forms.
  - b. Add 10 to 15 drops of HCl to each well containing a sample.
  - c. Observe and record each result. Decide which elements reacted with the acid and which did not (*no visible reaction detected*).
  - d. Pour the contents of the well plate into the waste beaker provided at the lab station. Carefully rinse out the well plate in your sink. Be sure your goggles are on! Remove pieces of element samples that fall into the sink and discard them in the trash can.
  - e. Wash your hands before leaving the testing station.

2. Test with copper(II) chloride ( $\text{CuCl}_2$ ) – *Most metals will react with  $\text{CuCl}_2$ .*
  - a. Place each element sample in its appropriate well in the well plate. Use **one piece** of the sample for wire or ribbon and a **few grains** for other forms.
  - b. Add 10 to 15 drops of  $\text{CuCl}_2$  to each well containing a sample.
  - c. Observe the wells for 3 to 5 minutes; change is slow. Record each result. Decide which samples reacted with copper(II) chloride and which did not.
  - d. Pour the contents of the well plate into the waste beaker provided at the lab station. Carefully rinse out the well plates. Be sure your goggles are on! Remove pieces of element samples that fall into the sink and discard. Use the sponge or paper towels to wipe the lab table.
  - e. Wash your hands before leaving the testing station.

### Data Table

Sample	Appearance	Malleability	Conductivity	Reaction with HCl	Reaction with $\text{CuCl}_2$
A					
B					
C					
D					
E					

### Analysis

In a well-developed paragraph, analyze and explain the results from the experiment.

- Identify each sample as a metal, nonmetal or metalloid.
- Justify the classification of the samples as metals, nonmetals, and metalloids using lab data.
- Compare the experimental results to the hypothesis and determine whether the hypothesis was supported by the lab data.

Write objectively, with sufficient detail to explain the results obtained.