

ACTIVITY 5: INVESTIGATING SINGLE REPLACEMENT REACTIONS



The purpose of this activity is for students to investigate two commonly mined metals—copper and iron—through a single replacement reaction.

Materials:

- 250 mL beaker
- Balance (scale)
- Copper (II) chloride (6.0 to 8.5 grams)
- Distilled water
- 2 or 3 small iron nails, or one large one
- Stirring rod
- Small beaker (100mL)
- Drying area or, optionally, a drying oven
- Safety goggles
- Lab apron (optional)

First, inform students that they will be conducting a multi-day lab to react iron metal with a solution of copper (ii) chloride. The focus of this lab is on the properties of the metals before and after the reaction takes place. Begin by showing students the iron nail, a piece of copper metal, and then the copper (ii) chloride powder. Ask them to note physical observations about each. Get them to focus on the fact that the copper has a completely different appearance when it is pure copper metal as when it is compounded with chloride.

Then, have them form groups of 4 and obtain the materials needed to perform the lab. Depending on your students experience with chemistry, you may need to review equipment, techniques, or even go over the lab procedure as a whole class before they begin conducting their lab. Make sure everyone understands the procedure before they begin.

Next, check to make sure everyone has their safety goggles on, and have students draw a particle diagram to represent the reactants in the lab (e.g., the iron and the copper (ii) chloride) as well as make a prediction of what they think will happen. Allow students to begin the procedure.

- **On Day 1:** Write your initials on an empty 250 mL beaker and use a balance to obtain and record its mass
- Measure between 6.0g – 8.5g of copper (II) chloride and add it to the beaker
- Write down the total mass of the beaker with the copper (II) chloride
- Add about 50 mL of distilled water to the beaker and stir until the copper (II) chloride dissolves completely.
- Record the mass of the iron nail(s) and then place them gently into the solution
- Watch what happens and write down your observations (like changes in color or bubbling) every few minutes
- Leave the beaker in a safe place designated by your teacher overnight.
- **On Day 2:** carefully remove the nail(s) from solution into an empty beaker and record any observations
- Rinse or gently scrape off the orange-colored solid that formed on the nails back into the beaker
- Carefully pour out the liquid from the beaker, trying not to lose any solid.
- Rinse the solid with about 25 mL of distilled water and pour out the water carefully
- Leave the beaker with the orange solid in a drying area or drying oven overnight
- **On Day 3:** mass the dry nails again and record their mass and any observations
- Mass the beaker with the dry orange record its mass and any observations.
- Perform the necessary calculations
- Draw particle diagrams of the products and compare to the reactant diagrams

Last, do the Lab Debrief as a whole class