



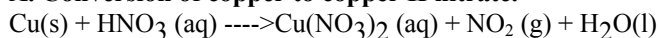
Copper Cycle

In this lab you will have an opportunity to observe a number of different types of chemical reactions and to write and balance some chemical equations. You will begin the lab with a piece of copper wire, convert the copper into a number of different compounds of copper and finally recover the copper. You should, according to the Law of Conservation of Mass have the same amount of copper at the end that you started with.

The unbalanced reactions are provided for you along with the procedure for the lab. In your lab report you should include the *balanced* equations.

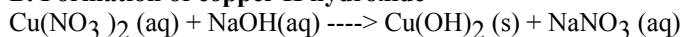
Materials:

Copper wire	Steel wool	Balance
Concentrated nitric acid	Deionized water	Wash bottle
Graduated cylinder	3M NaOH	Red litmus paper
Stirring rod	Ring and ring stand	Wire gauze square
burner	Filter paper	2M sulfuric acid
Mossy zinc	beakers	Hydrochloric acid

Procedure:**A. Conversion of copper to copper II nitrate.**

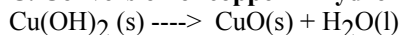
Caution: Nitric acid is extremely corrosive. Avoid spilling it on yourself. If you do, rinse it immediately with a great deal of water and call your instructor. If it is spilled on your clothes, remove the affected clothing, then rinse the area thoroughly, and call your instructor. The reaction between copper and nitric acid produces a brown gas, NO_2 , that is highly toxic. **DO NOT PERFORM THIS REACTION ANYWHERE BUT IN A FUNCTIONING HOOD!**

Obtain a piece of copper wire with a mass of approximately 0.5 grams. Clean the wire with steel wool and find the exact mass. Make any observations that you can and then place the wire flat on the bottom of a 200 ml beaker. Take the beaker to the hood and carefully add 5 ml of concentrated nitric acid. Your instructor will help you with this process. Make any observations that you can about the process and the products. If the copper does not completely dissolve add a bit more nitric acid (not more than one ml!) and stir the mixture gently by slowly swirling the beaker. When the reaction is complete, dilute the solution with deionized water to approximately 100 ml, and note any change in color or appearance.

B. Formation of copper II hydroxide

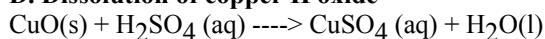
CAUTION: Sodium hydroxide is highly corrosive, especially to eyes. Treat this as you would any dangerous spill. Remove any affected clothing and rinse the area very thoroughly. Call your instructor. NOTE: Base burns (Like those you get from sodium hydroxide) can be deceptive. Just because it doesn't hurt now doesn't mean you shouldn't worry. Base burn pains come late!

Take your beaker back to your lab station and slowly add 20 ml of 3.0 M NaOH. Stir the solution and record any changes. Test the solution with litmus paper to see if it is basic. (Red litmus paper turns **Blue** in **Base**) To use litmus paper, **DO NOT** dip the paper into the beaker. Instead, take your stirring rod and transfer one drop from the beaker to the paper and observe a color change. If it is not basic continue to add NaOH solution (in 10 ml amounts) until it is basic.

C. Conversion of copper II hydroxide to copper II oxide

Place the beaker on a wire screen on a ring stand. Stir the solution while CAREFULLY bringing it to a gentle boil. If the boiling becomes severe you may need to transfer your solution to a larger beaker. Be sure to rinse any residue into your new beaker (You don't want to lose copper!). Boil the solution until all of the precipitate has changed color. Remove the heat and allow the suspension in the beaker to settle.

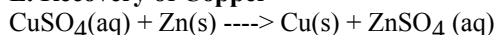
When the solid has settled, filter the solution through a piece of filter paper into another beaker. The solid is gummy and this process will be slow. You can make it more efficient by transferring as much of the liquid as possible BEFORE you transfer any solid into the filter paper. Wash the solid by pouring deionized water through it at least 3 times.

D. Dissolution of copper II oxide

CAUTION: Sulfuric acid is corrosive. Avoid all contact with this acid. If you spill it follow the same procedure as above. Remove any affected clothing, rinse thoroughly and call your instructor.

Dissolve the solid CuO by placing the filter paper into a 250 mL beaker and adding 10 ml of 2M H₂SO₄. Use your stirring rod to gently push the filter paper so that all of the copper oxide is in contact with the sulfuric acid. Note any changes and colors. It will take several minutes for the copper oxide to dissolve. (While waiting weigh out the zinc for the next step.)

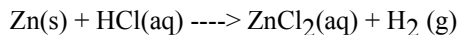
When the copper oxide is completely dissolved, use a pair of tweezers to lift the filter paper out of the beaker. Holding it over the beaker, rinse it with deionized water until no trace of copper compounds remains. Discard the paper.

E. Recovery of Copper

Add approximately 1.0 gram of Zn to the solution and stir it. Solid copper should collect on the bottom of the beaker and the solution should become colorless. If the zinc is completely gone and the solution is not colorless add more zinc.

CAUTION: Hydrochloric acid is corrosive. Avoid all contact with this acid. If you spill it follow the same procedure as above. Remove any affected clothing, rinse thoroughly and call your instructor.

The extra reaction :



After the solution is clear and colorless, add approximately 2 ml of concentrated HCl to dissolve any remaining Zn.

Label a piece of filter paper with your names (in pencil) and mass it. Filter the copper through the filter paper. Rinse the copper in the filter paper with deionized water. Remove the paper and spread it out on a watch glass. Place the watch glass and paper in the oven to dry. When the paper is dry, mass it.

Calculations:

Determine the mass of copper recovered.

Calculate the grams of product that should be produced for each step in the lab.

Calculate the percent yield of the lab.