

## Copper Odyssey Conversion II

**Conversion II (Day 2) - Changing copper (II) nitrate to copper (II) hydroxide.**

15 minutes

**SAFETY:** NaOH is a VERY strong base and will burn skin & eyes upon contact. Wear apron and goggles at all times! Rinse with water if you come into contact with base.

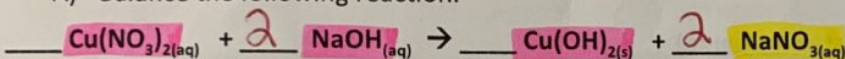
- 1) Complete the conversion II pre-lab questions (A-B) and III pre-lab questions (A-B)
- 2) Find your sample from last class. Look at the sample and describe the material produced on the data table below.
- 3) The copper nitrate solution should still be acidic. To test this, get a piece of blue litmus paper and a stirring rod.
- 4) Dip the stirring rod in the solution, then touch it to blue litmus paper. Record the color in the data table below.
- 5) This reaction produces a lot of heat, so we will create a cooling bath. Put the flask with  $\text{Cu}(\text{NO}_3)_2$  solution inside a 500mL beaker (or larger if needed) containing ~50mL ice cold water.
- 6) Measure out 20 mL of 6M NaOH in a graduated cylinder.
- 7) Slowly pour 20mL of 6M NaOH into the  $\text{Cu}(\text{NO}_3)_2$  solution. Stir for 2 minutes.
- 8) Wash and dry your stirring rod and get a piece of red litmus paper.
- 9) Dip the stirring rod in the solution, then touch it to blue litmus paper. Record the color in the data table below.
- 10) Did the paper turn **DARK BLUE?** (not just the blue color of your solution- the litmus paper must turn **DARK BLUE**).
  - If not dark blue then it is NOT a basic solution. Add 5mL more of NaOH and recheck with a clean stirring rod and new red litmus paper. Continue adding 5 ml of NaOH until solution is basic and appears **Dark blue** in color
  - If dark blue Record your observations under Conversion II and go on to Conversion III
- 11) Describe the color and texture below.

6M NaOH

blue litmus paper  
ice

**Pre-lab:**

A) Balance the following reaction.



B) Translate the above equation into names and states of matter (use polyatomic ion sheet and periodic table)

Copper (II) nitrate reacts with sodium hydroxide to produce  
Copper (II) hydroxide and sodium nitrate.

**Observations:**

Get your sample and describe it here before starting:

Solution	Color of litmus paper	Acidic or basic
Copper Nitrate - $\text{Cu}(\text{NO}_3)_2$	Blue litmus paper turned = <u>(red/stays blue)</u> <small>circle one</small> • If Blue litmus turns red = Acidic • If Blue litmus stays blue = basic	<u>(Acid or base)</u> <small>circle one</small>
Copper Nitrate + Sodium Hydroxide $\text{Cu}(\text{NO}_3)_2 + \text{NaOH}$	Red litmus paper turned = <u>(Dark blue/stays red)</u> <small>circle one</small> • If red litmus turns dark blue = Basic • If red litmus stays red = acidic	<u>(Acid or base)</u> <small>circle one</small>

**Observations:**

Describe the color & texture of your sample after the NaOH was added:

## Version II Questions

What type of chemical reaction is Conversion II? Explain your reasoning: (synthesis, decomp., single displacement, double displacement, more than one?)

double displacement

2. Fill in the chart

compound	Describe: state of matter & color	Bond type ionic, nonpolar covalent, or polar covalent
$\text{Cu}(\text{NO}_3)_2$	liquid blue	ionic
$\text{NaOH}$	<del>liquid</del> colorless	ionic
$\text{Cu}(\text{OH})_2$	solid blue	ionic
$\text{NaNO}_3$	liquid	ionic

3. Which of the substances in the reaction were a base? (look at the formulas)

$\text{NaOH}$

4. What does pH stand for? potential for Hydrogen What is the pH range of a base? 7.1-14

5. Describe what test can be done to quickly determine if a substance is an acid, a base or neutral?

Litmus paper test

6. How did we determine whether or not we had added enough sodium hydroxide?

added until litmus paper turned basic

7. What is the pH range of the solution at the end of conversion II? 7.1-14

8. Why did we use an ice bath? (Hint: Read procedure step 5) the rxn produces a lot of heat

9. Is the reaction exothermic or endothermic? Explain.

exothermic - heat/energy is produced

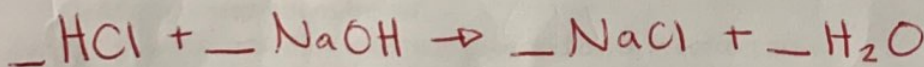
10. The blue solid formed also had solid flecks of black. What are the solid black flecks? (look at the balanced equation)

Copper (II) oxide

11. What is the mole ratio of  $\text{Cu}(\text{NO}_3)_2$  to  $\text{NaOH}$ ? (look at the balanced equation) 1:2

12.  $\text{Cu}(\text{NO}_3)_2$ ,  $\text{NaOH}$ , and  $\text{NaNO}_3$  are aqueous. What does aqueous mean? water-like

13. Write a balanced equation of Hydrochloric acid with sodium hydroxide and predict the products.



14. The reaction from #13 of an acid plus a base is called a neutralization reaction. Neutralization reactions "neutralize" both the acid and the base so that they are no longer harmful. The reaction produces a "salt" and water.

Name the salt produced in #13: sodium chloride

## Copper Odyssey Conversion III

Conversion III (Day 2) - Changing copper (II) hydroxide to copper (II) oxide **20 minutes**

**SAFETY:**  $\text{Cu}(\text{OH})_2$  is a strong base and will burn skin & eyes upon contact. Wear apron and goggles at all times! Rinse with water if you come into contact with base.

1) Make sure you have completed pre-lab questions (A-B) for conversion III.

### Hot water bath

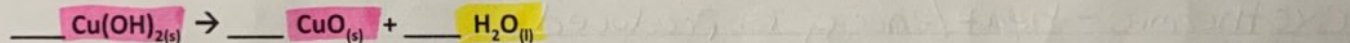
- 2) Place flask containing the  $\text{Cu}(\text{OH})_2$  into the warm water bath at  $(37^\circ\text{C})$ - Don't let it tip over!! The warm water will speed up the reaction. distilled  $\text{H}_2\text{O}$
- 3) Leave in hot water for 10 to 20 minutes.
- 3) Return to your desk and work on Conversion II questions until reaction is complete.
- 4) Check on your reaction and record your observations of the material produced under Conversion III

### Filter paper separation

- 5) Fold and place filter paper into a large funnel and set on top of a 400 ml flask.
- 6) Get a distilled wash bottle.
- 7) Carefully pour the contents of the small flask into the filter lined funnel
- 8) Rinse the small flask with distilled a stream of distilled water from the wash bottle then pour into filter. Try and get all of the material out to the small flask and into the filter paper.
- 9) Rinse the  $\text{CuO}$  in the filter paper with a stream of distilled water. **USE Caution to not rip filter paper.**
- 10) Remove the label from your small flask and place on the large flask.
- 11) Place the funnel and large flask in the proper area and leave overnight.
- 12) Scrub out your small flask with a brush and soap. Put it on the drying rack.
- 13) clean up your area.
- 14) Answer Conversion II and III questions for homework.
- warm  $\text{H}_2\text{O}$  bath  
funnel  
filter paper  
wash bottle

### Pre-lab:

A) Balance the following reaction.



B) Translate the above equation into names and states of matter (use polyatomic ion sheet and periodic table)

Copper (II) hydroxide decomposes into copper (II) oxide and water.

### Observations

After Hot water bath: (color/texture):

### ★ Conversion III Questions

1. What type of chemical reaction is Conversion III? **Explain your reasoning:** (synthesis, decomp., single displacement, double displacement, more than one?)

decomposition

in the chart:

Compound	Describe: state of matter & color	Bond type ionic, covalent, or metallic
$\text{Cu}(\text{OH})_2$	solid blue	ionic
$\text{CuO}$	solid black	ionic
$\text{H}_2\text{O}$	liquid colorless	polar covalent

3. Why did we put the bottle in the hot water bath?

heat helped decompose & speed up the reaction

4. What is the formula of copper (II) oxide?  $\text{CuO}$

5. What is the purpose of filter paper?

separates copper (II) oxide from  $\text{H}_2\text{O}$

6. What is the charge of copper in  $\text{CuO}$ ?  $2+$  How do you know? oxygen is  $2-$  & they must balance to zero

7. What is the charge of copper in copper (I) oxide?  $1+$  What is the formula of copper (I) oxide?  $\text{Cu}_2\text{O}$

8. We used a water bath at  $37^\circ\text{C}$ . What is the temperature in Kelvin? (Show work; hint:  $\text{C}=\text{K}+273$ )

$$37 + 273 = 310\text{K}$$