

Name _____

How much solid copper can you get from this blue solution?

- How can a balanced chemical equation help determine the relationship between starting amounts and ending amounts?
- What is the relationship between how much you start with and how much you produce?
 - Are reactions perfect?

Your Task:

Determine the grams of solid copper that will be produced from your sample in this copper cycle lab.

You will be using two chemical equations to determine the amount of your product.

1. Draw a mass of copper II nitrate. This will be your starting sample of copper for this lab. Record the mass of your copper II nitrate as well as the volume of prepared solution that you will be using. _____

2. In the list to the right, you will find several solutions that are available for this task. Not all of the solutions will produce a result. You must decide which solution to use.

a. What kind of reaction will this be? _____

b. What are the rules/ patterns for this type of reaction?

c. Which solution will you work with based on those rules? Why?

3. Using your chosen solution, write a BALANCED chemical equation.

Available Solutions:

Hydrochloric acid

Sodium chloride

Sodium carbonate

Calcium nitrate

Commented [SS1]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Define, identify, and predict products for synthesis (direct combination), decomposition, single replacement, double replacement, and combustion reactions. (DOK-3 assessment)

4. Write the net ionic equation for the reaction above.

5. How many moles of copper II nitrate will you be using?
6. How many moles of sodium carbonate will you need?
7. How many moles of copper II carbonate will you produce?
8. How many moles of sodium nitrate will you produce?

Obtain the Mole Ratio POGIL from your teacher. Follow all the directions and stop signs. Raise your hand when your group reaches a stop sign or needs help.

Commented [SS2]: The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms. (HS-PS1-3), (secondary to HS-PS2-6)
•Write equations for the dissociation of ionic compounds and ionization of molecular compounds (DOK-3 Assessment)

Commented [SS3]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2), (HS-PS1-7)
•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution. (DOK-2 Assessment)

Commented [SS4]: The goal here is to allow students the opportunity to recognize that they need to learn "something" to be successful. Prior to this activity my students DO NOT know how to answer questions 6,7 and 8 but I gave them the opportunity anyway. They ended up being much more receptive to the mole ratio and learning stoichiometry because they had already decided that the needed to.

Using the information learned in Mole Ratio POGIL, you must now perform stoichiometric calculations to proceed with the lab.

For step one in the lab you will need to calculate the volume of sodium carbonate necessary for the reaction and the number of grams of copper II carbonate produced. Some useful information about sodium hydroxide is provided. Remember 1000 mL = 1 L

Sodium carbonate: $\frac{1.00 \text{ moles NaOH}}{1 \text{ Liter}}$	Copper II carbonate:
Volume required _____	Grams produced _____

Commented [SS5]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution. (DOK-2 Assessment)

Commented [SS6]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution. (DOK-2 Assessment)

Check in with your teacher for a "math check". Perform step one in the lab after approval.



Data table/ observations (sight, touch(outside the tube)):

ALL observations and data will be recorded in this space!

A second reaction will begin automatically using **only** the copper II carbonate. Write a balanced chemical equation for this reaction. In part two you will follow directions to make sure this reaction goes to completion.

What type of reaction is this? _____

Commented [SS7]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)
Define, identify, and predict products for synthesis (direct combination), decomposition, single replacement, double replacement, and combustion reactions.
(DOK-3 assessment)

Calculate the mass of copper II oxide that will be produced in the second reaction. You will need to use previous calculations to help you get started.

Mass of copper II oxide _____

Check in with your teacher for a "math check". Perform step two in the lab after approval.

Answer the following questions after completing part two.

1. Was copper present in the decanted solution (the solution you pipetted off) from part two? How do you know?

2. What does the presence/absence of copper from the decanted solution tell you about your experiment so far?

Commented [SS8]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)
•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution.
(DOK-2 Assessment)

Commented [SS9]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)
•Define, identify, and predict products for synthesis (direct combination), decomposition, single replacement, double replacement, and combustion reactions.
(DOK 4- assessment)

Part Three

You will now begin the process of isolating your solid copper sample. Your test tube now contains copper I oxide. The copper has changed its charge.

Available Solutions:

Hydrochloric acid

Sodium chloride

Sodium carbonate

Calcium nitrate

Commented [SS10]: This was cool for accelerated chemistry because they recognized that it was better to follow their numbers through in moles... For general chemistry I had them completely ignore this fact and just proceed using Copper II oxide

Look at the list of available solutions, and choose a solution that will react with copper I oxide. Write a balanced chemical equation.

Commented [SS11]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)
Define, identify, and predict products for synthesis (direct combination), decomposition, single replacement, double replacement, and combustion reactions. (DOK-3 assessment)

What type of reaction is this? _____

Calculate the mass of copper I chloride that will be produced in the third reaction. You will need to use previous calculations to help you get started.

Mass of copper I chloride _____

Commented [SS12]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution. (DOK-2 Assessment)

Calculate the amount of hydrochloric acid that you will need to use for this reaction. 1000 mL = 1 L

HCl $\frac{2.95 \text{ moles}}{1 \text{ L}}$

Volume of HCl _____

Commented [SS13]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution. (DOK-2 Assessment)

Immediately following the production of copper I chloride, you will isolate your solid copper. For this step you will use aluminum wire. What product from the previous equation will the aluminum react with? _____

What type of reaction will this be? _____

Write the balanced chemical equation for the reaction, and calculate the mass of solid copper that you will produce.

Mass of solid copper _____

Commented [SS14]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

Define, identify, and predict products for synthesis (direct combination), decomposition, single replacement, double replacement, and combustion reactions. (DOK-3 assessment)

Commented [SS15]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Perform stoichiometric calculations from balanced equations in order to find number of atoms or molecules, moles, grams, liters of a gas, and liters of solution. (DOK-2 Assessment)

Questions:

1. What was your theoretical(calculated) yield for solid copper? _____
What was your actual (lab produced) yield for solid copper? _____
Calculate your percent yield? _____ $\frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100\% = \text{Percent yield}$

2. Did your theoretical yield match your actual yield? _____ elaborate on your answer using your data and your observations from the lab to explain why or why not.

3. Assuming that you filtered out ALL of the solid copper from your solution, what compound remained in the filtered solution? _____

Was any copper II chloride still in the solution? _____ How do you know?

Write a balanced chemical equation for the addition of AgNO_3 to your filtered solution.

The use of silver nitrate in this step allowed you to identify the presence of which ion?

Commented [SS16]: •The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Distinguish between theoretical yield, actual yield and use to determine percent yield.
(DOK-2 Assessment)

Commented [SS17]: The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe and predict chemical reactions. (HS-PS1-2),(HS-PS1-7)

•Define, identify, and predict products for synthesis (direct combination), decomposition, single replacement, double replacement, and combustion reactions.
(DOK 4- assessment)