

Name: \_\_\_\_\_ Teacher: \_\_\_\_\_

## MS-PS1-2: Assessment Task - Chemical Change - Copper Sulfate



**Copper Sulfate Crystals**



**Copper Sulfate Powder**



**Copper Sulfate dissolved in Water (Solution)**

Copper sulfate is a chemical compound that contains copper, sulfur, and oxygen atoms. It is found in nature as a mineral crystal. It is also manufactured as a powder for use in agriculture and medicine to kill algae, bacteria, and fungus, or as an addition to many chemical substances like paint and dyes. Copper sulfate solution reacts with a number of metals. A group of students were asked to test several types of metal to determine if they react chemically with copper sulfate. Their teacher provided them with the following materials:

- Copper sulfate solution
- Test tubes and a test tube rack
- Graduated cylinder
- Small pieces of four different metals: iron (Fe), aluminum (Al), magnesium (Mg), and zinc (Zn)

They designed the following procedure:

- Create a data table to record results.
- Put on goggles.
- Measure 10 milliliters of copper sulfate solution into each of five labeled test tubes. Record the color of the solution.
- Record the mass of each test tube with solution.
- Observe metal pieces of iron (Fe), aluminum (Al), magnesium (Mg), and zinc (Zn). Record their color and texture.
- Measure and record the mass of each piece of metal.
- Add a different type of metal to four of the test tubes.
- Observe for 30 minutes and record changes.
- Record the color of the liquid in the test tube after 30 minutes.
- Record the color/texture of each metal in the test tube after 30 minutes.
- Find and record the total mass of the test tube, liquid, and metal after 30 minutes.



Do not add metal to the 5<sup>th</sup> test tube.



**Fe Al Mg Zn**

After obtaining permission from their teacher, the students conducted their investigation. Their results are shown in the table below.

**STUDENT DATA TABLE**

Metals Tested	Before					After 30 Minutes				
	Color of Copper Sulfate (CuSO <sub>4</sub> ) Solution	Metal Color	Metal Texture	Mass (tube and liquid)	Mass (metal)	Solution Color	Metal Color	Metal Texture	Bubbles Present	Total Mass (tube, liquid, and metal)
Iron (Fe)	Blue	Dark gray - dull	Uneven and Hard	30 grams	16 grams	Light Yellow-Green	Dark Reddish - Brown	Rough and crumbly	None	46 grams
Aluminum (Al)	Blue	Silvery gray - shiny	Smooth and Hard	30 grams	5.5 grams	Light Blue	Reddish Brown	Rough and bumpy	Many	34.5 grams
Magnesium (Mg)	Blue	Gray - shiny	Jagged and Hard	30 grams	4.5 grams	Pale Blue	Dark Reddish -Brown	Rough and bumpy	Many	33.5 grams
Zinc (Zn)	Blue	Gray - dull	Smooth and Hard	30 grams	14 grams	Clear	Reddish -Black	Rough and flaky	Some	43.5 grams
No Metal	Blue	-	-	30 grams	-	Blue	-	-	None	30 grams

**TASK 1**

**1A.** Why do you think the students included a tube of copper sulfate to which they did not add metal in their investigation?

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**1B.** The students made a claim that a chemical reaction happened in **all four** of the test tubes to produce new substances. Describe *at least* two different patterns within the data that provide evidence to support this claim.

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1C. The students thought that the total mass of the test tube, liquid, and metal should remain the same before and after the metal was added to the liquid because mass is conserved (remains the same) in a chemical reaction. This only happened in one of the test tubes. Use the data and your understanding of chemical reactions to explain why the total mass was less than the original mass in the other tubes.

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## TASK 2

2A. The first reaction from the data table between iron and copper sulfate can be represented using the following chemical sentence:

***Iron metal and copper sulfate combine to produce iron sulfate and copper metal.***

Draw a model of this chemical sentence. Be sure to include iron, copper, and sulfate in your model. You may use the symbols on the right or create your own.



Iron  
(Fe)

Copper  
(Cu)

Sulfate  
(SO<sub>4</sub>)

2B. In the chemical reaction above, iron metal and copper sulfate are the **reactants**. Copper metal and iron sulfate are the **products**. Use the information in the table to describe the *physical properties* of each of the products and reactants in this chemical reaction.

**Physical properties of the reactants** \_\_\_\_\_

\_\_\_\_\_

**Physical properties of the products** \_\_\_\_\_

\_\_\_\_\_

2C. Complete each of the chemical sentences below based on the pattern observed in the data and the information from the previous questions.

**Aluminum metal and copper sulfate combine to produce** \_\_\_\_\_

**Magnesium metal and copper sulfate combine to produce** \_\_\_\_\_

**Zinc metal and copper sulfate combine to produce** \_\_\_\_\_

2D. What is happening to the atoms and molecules in **all** of these reactions to cause the changes seen in the physical properties of the substances? Use the data table and the patterns you identified in Task 2 as evidence.

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### TASK 3

3A. Make a claim about what will happen if copper metal is mixed with copper sulfate.

**Claim:** If copper metal is mixed with copper sulfate...

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Use the pattern in the chemical reactions from this investigation to support your claim.

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3B. Copper is a reddish-brown metal with a shiny appearance. Copper sulfate is a bright blue crystal substance. If each of these substances contain copper, why do they have such different colors? Use evidence from your analysis to support your explanation.

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