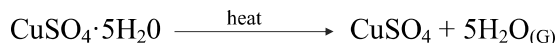


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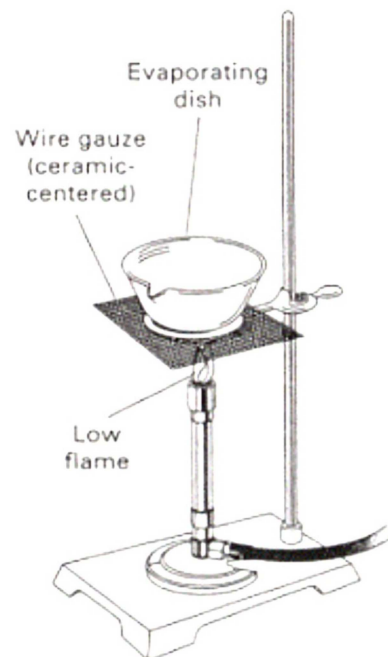
A hydrate is an ionic compound that has a specific amount of water as part of its structure. The water is loosely bonded to the compound. Different hydrated ionic compounds will have different amounts of water molecules that normally attach, but the number of water molecules is specific for each given hydrate. You will be using copper (II) sulfate pentahydrate. (pentahydrate = 5 water molecules per formula unit)

When a hydrate is heated this water is released as steam. The dehydrated ionic compound is now called an anhydrous salt. This hydrate is blue in color, while the anhydrous salt is white. When the water (the hydrate part) escapes as steam, you're left with just copper (II) sulfate.



Using the percent composition by mass formula, you can measure the water in this hydrate, then compare it to the actual value that you calculate. This lab works well if you are careful.

THE FORMULA FOR THIS COMPOUND IS:



PROCEDURE:

1. Get equipment set up as shown by teacher. Mass the evaporating dish empty (and dry).
2. Add 3.00 grams of our hydrate (the $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$), start heating - not super hot, just enough to evaporate the water.
3. While heating for 14 minutes, calculate the molar mass of this compound on the next page. Then do the percent composition by mass for this compound as well. The water will be kept "whole", do not do "H" and "O".
4. After 14 minutes, fire off. Cool your evaporating dish on the table for 4 minutes, record the mass the dish with the salt.
5. Re-heat for two minutes. Cool down for 4 minutes, and then mass it again. If the mass has remained within 0.01 gram you are done. If not, you must repeat this step.
6. When the dish is completely cooled down, add some water to the white salt and see what happens.

Two very important safety items:

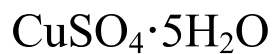
Hot evaporating dishes do not look hot but they can be skin burning hot!
Hot dishes can melt the tops of the scales.
The tops of the scales cost \$25 each.

Please say out loud to your lab partner:

**"I promise to cool my evaporating dish before putting them on the scales,
AND before adding water at the end".**

Calculate the molar mass of copper (II) sulfate pentahydrate. Then do the percent composition by mass for all of the compound. Please TREAT THE WATER as a unit, List Cu, S, O, and H₂O. Do not break up the WATER!

Molar mass



% Comp by mass

	Data Table	Mass in grams		
A	Mass of evaporating dish empty			Scale mass
B	Mass of evaporating dish + blue hydrate			A + 3.00 g
C	Mass of evaporating dish + the white salt	After first heating	After last heating	Scale mass
D	Mass of white anhydrous salt left over			C - A =
E	Mass of the evaporated water			3.00 g - D =

Lab Questions - do on loose leaf paper - SHOW WORK + Formulas

1. State the % comp by mass of water in hydrate (the actual value)
2. Calculate % comp by mass of water in your 3.00 grams of hydrate (write the formula from the reference table first, this is your measured value)
3. Calculate your percent error (SF and sign required)
4. Redraw this chart into your questions, fill in the blanks with units.

	Species	Molar mass (with unit)	Atomic mass (with unit)
A	<i>One Cu</i>		
B	<i>One S</i>		
C	<i>Four O</i>		
D	<i>Five H₂O</i>		
E	<i>One CuSO₄·5H₂O</i>		

5. What is the mass of 5.00 moles of this hydrate?
6. What is the mass of 5.00 formula units of this hydrate?
7. Where did the water in your CuSO₄·5H₂O go?
8. The CuSO₄ anhydrous salt, which is white, turn blue again when you dripped some water into the evaporating dish at the end of this lab experiment. What happened there?
9. Calculate the % comp by mass for water in magnesium nitrate hexahydrate.
10. Calculate the % comp by mass for water in barium hydroxide octahydrate.
11. Calculate the % comp by mass for water in mercury (I) nitrate monohydrate.
12. Calculate the % Comp by mass of water in vanadium (V) bromide dihydrate.
13. Skip this one
14. Define Anhydrous Salt
15. How many formula units of copper (II) sulfate pentahydrate are in 3.00 grams?
16. How many grams of your 3.00 grams of CuSO₄·5H₂O are copper?

page	This lab requires	points
Cover	Title, short intro paragraph	1 + 1 = 2
2	The 15 questions above	15
Last	Write a short summary of what the point of the lab experiment was. State specifically: what did you measure, what did you calculate, what's your percent error, and why did you get it? What do you conclude about this concept of Percent Composition by mass. Make sure you use your data numbers: do not hint at anything, say it clearly.	8 25 total points