Magnesium Sulfate Heptahydrate Lab

$MgSO_4 \cdot 7H_2O$ Percent Comp by Mass 40/1200 minutes name ___________________________________

We have already seen that 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 numbers of molecules of water that normally attach to it. We saw that $CuSO_4$ holds 5 water molecules (pentahydrate). This lab uses the compound magnesium sulfate heptahydrate which holds 7 waters at a time.

When a hydrate is heated this water is released as steam. The dehydrated ionic compound is now called an anhydrous salt. This hydrate is white in color, and so is the anhydrous salt. When the water (hydrate part) escapes as steam, you're left with just magnesium sulfate—the anhydrous salt. There is NO COLOR CHANGE in this lab.

$$MgSO_4 \cdot 7H_2O_{(S)} \xrightarrow{\text{heat}} MgSO_{4(S)} + 7H_2O_{(G)}$$

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.

PROCEDURE:

1. Get equipment set up as shown by teacher. Mass the evaporating dish empty and dry. Data on page 2.
2. Put 3.15 grams of the $MgSO_4 \cdot 7H_2O$ into the evaporating dish, heat the evaporating dish for 14 minutes.
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.
4. After heating, cool your evaporating dish on the table for <u>4 minutes</u>, record the mass the dish with the salt.
5. Re-heat for four minutes. Cool down for <u>4 minutes</u>, and then mass it again. The mass of the dish/salt may have decreased (or not). We will discuss that.

An important safety item:

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

Please say out loud to your lab partner:

"I promise to cool my evaporating dish before putting them on the scales.

Wash the leftover compound into the sink drain. It's totally safe

	Data Table	Mass in grams	This is…
A	Mass of evaporating dish empty		Mass of empty dish
B	Mass of evaporating dish + white hydrate		Dish + 3.15 g hydrate
C	First Mass of evaporating dish + the white salt		Dish + dehydrated salt
D	Second Mass of evaporating dish + the white salt		Dish + dehydrated salt
E	Mass of just the anhydrous salt		"D" minus "A"
F	Mass of the evaporated water		3.15 g minus "E"

Calculate the molar mass of magnesium sulfate heptahydrate. Then do the percent comp. by mass .
TREAT THE WATER as a unit: Calculate for: Mg, S, O, and H_2O.

Molar mass

<u>$MgSO_4 \cdot 7H_2O$</u>

Mg

S

O

H_2O

<u>% Comp by mass</u>

Mg

S

O

H_2O

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

1. State the % comp by mass of water in $MgSO_4 \cdot 7H_2O$ (the actual value) (you already did this on page 2)

2. Calculate % comp by mass of water in your 2.95 grams of the $MgSO_4 \cdot 7H_2O$
   (You MUST write the % comp formula from the reference table first) (the measured value)

3. Calculate the percent error between your measured percent comp water and the actual percent comp by mass of water in the compound. (SF and sign required)

4.	Species	Molar mass (with unit)	Atomic mass (with unit)
A	*One* Mg		
B	*One* S		
C	*Four* O		
D	*Seven* H_2O		
E	*One* $MgSO_4 \cdot 7H_2O$		

Copy this table into your questions, fill it in, with units.

5. What is the mass of 7.00 moles of $MgSO_4 \cdot 7H_2O$?

6. What is the mass of 7.00 formula units of $MgSO_4 \cdot 7H_2O$?

7. Calculate the percent composition by mass of bismuth in bismuth (III) oxalate. (round to whole number)

8. Calculate the percent composition by mass of iron in iron (III) dichromate. (round to whole number)

9. How many formula units of magnesium sulfate heptahydrate are in 3.15 grams of $MgSO_4 \cdot 7H_2O$?

10. Calculate how many formula units are in 182.7 grams of $MgSO_4 \cdot 7H_2O$

11. Skip this one

12. How many grams of magnesium are in 3.15 grams of $MgSO_4 \cdot 7H_2O$?

13. One pound is 454 grams. How many grams of sulfur are in exactly 454 grams of $MgSO_4 \cdot 7H_2O$?

14. How many grams of water are in exactly 454 grams of $MgSO_4 \cdot 5H_2O$?

15. If you have 125 grams of bismuth (III) oxalate, how many grams are just bismuth?

16. If you have 333 grams of iron (III) dichromate, how many grams are just chromium?

<table>
<tr><td>page</td><td>This lab requires</td><td>points</td></tr>
<tr><td>Cover</td><td>Title, short intro paragraph</td><td>1 + 1 = 2</td></tr>
<tr><td>2</td><td>The 15 lab questions</td><td>15</td></tr>
<tr><td>Last</td><td>Conclusion
1. Write a short summary of what you did, and what the point of the lab experiment was.

2. State specifically:
a. what did you measure
b. what did you calculate
c. what's your percent error
d. why did you get this percent error.

3. What generalizations can you make about the concept of Percent Composition by Mass.

Make sure you use <u>your data</u>: do not hint at anything, say what you mean and mean what you say, and make sure it's clear. Read it out loud to be sure. This conclusion should be perfect!</td><td>8</td></tr>
<tr><td></td><td>This lab is due on ___________________________</td><td>25 total points</td></tr>
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