**Name:** Elle Nguyen **Lab Instructor:** Mohammad Robel Molla

**Date:** 10/27/2022

**POST-LAB REPORT #7**

**The Empirical Formula of Selected Hydrates**

**I. Calculations:**

* Mass of water (lost) for CuSnO = **0.328 g**

= **29.757 g**

= **30.868 g**

= – = 30.868 g – 29.757 g = **1.111 g**

- After 1st heating:

* = **30.625 g**
* = –

= 30.868 g – 30.625 g = **0.243 g**

- After 2nd heating:

* = **30.542 g**
* = –

= 30.625 g – 30.542 g = **0.083 g**

- After 3rd heating:

* = **30.540 g**
* = –

= 30.542 g – 30.540 g = **0.002 g**

Total for CuSnO = 0.243 g + 0.083 g + 0.002 g = **0.328 g**

* Mass of water (lost) for Unknown hydrate = **0.245 g**

= **29.251 g**

= **30.325 g**

= – = 30.325 g – 29.251 g = **1.074 g**

- After 1st heating:

* = **30.082 g**
* = –

= 30.325 g – 30.082 g = **0.243 g**

- After 2nd heating:

* = **30.080 g**
* = –

= 30.082 g – 30.080 g = **0.002 g**

Total for Unknown hydrate = 0.243 g + 0.002 g = **0.245 g**

* Moles of anhydrous CuS = **0.00491 moles**

= – = 30.540 g – 29.757 g = **0.783 g**

moles of anhydrous CuS = = = **0.00491 moles**

* Moles of anhydrous Unknown salt = **0.00513 moles**

= – = 30.080 g – 29.251 g = **0.829 g**

moles of anhydrous Unknown salt = = = **0.00513 moles**

* Mole ratio of O to anhydrous CuS = **4 : 1**

moles of water lost = = = **0.0182 moles**

moles of anhydrous CuS = **0.00491 moles** (above) smallest number of moles

mole ratio of water lost to anhydrous CuS = moles of water lost : moles of anhydrous CuS

= 0.0182 : 0.00491

= 3.70672 : 1

= **4 : 1 ratio**

* Mole ratio of O to anhydrous Unknown = 3 : 1

moles of water lost = = = **0.0136 moles**

moles of anhydrous Unknown salt = **0.00513 moles**  smallest number of moles

mole ratio of water lost to anhydrous Unknown = moles of water lost : moles of anhydrous Unknown salt

= 0.0136 : 0.00513

= 2.65107 : 1

= **3 : 1 ratio**

**II. Additional questions:**

*1. In step 9 you added water to your dehydrated copper(II) sulfate. Was your rehydration endothermic (heat absorbing) or exothermic (heat released)? What other observations did you make?*

The reaction is exothermic (heat released). When adding water to CuS blue vitriol

CuS + 4O CuSO, therefore the color is blue and it’s a crystalized solid.

*2. A student’s dehydration experiment with the hydrate of copper(II) sulfate yielded a blue sample after the final heating step. How is that observation likely to affect the calculated mass of water lost and the calculated formula for the original hydrate?*

The observation is likely to affect the resulting mass of water loss to not accurately resemble a ratio of 4 moles of O to 1 mole of anhydrous CuS. The ratio and the formula are related. Therefore, if the experimental ratio is not 4O : 1 CuS then the calculated empirical formula will not be accurate because there is likely water remaining in the sample hence the blue color. If the sample was completely dehydrated then the color would be white/blue-ish powder.

*3. Calculate the mass percent of water in your Unknown sample. Show calculations clearly and neatly, with correct significant figures and all units.*

Mass percent of water in Unknown sample = x 100

= x 100 = 22.8119 % **22.8 %**

*4. Successively heating a sample yielded the following data. When the student disposed of the sample they noticed several black spots on the bottom of the dehydrated sample. Briefly explain what’s happening during each heating and with which heating the student should have stopped.*

|  |  |  |
| --- | --- | --- |
| Mass before heating: | 1.50 g | initial mass |
| Mass after 1st heating: | 1.20 g | loss of water |
| Mass after 2nd heating: | 1.12 g | loss of water |
| Mass after 3rd heating: | 1.05 g | loss of water |
| Mass after 4th heating: | 1.03 g | last heating |
| Mass after 5th heating: | 1.11 g | burned sample caused mass to increase |
| Mass after 6th heating: | 1.14 g | burned sample caused mass to increase |

During the 1st heating through the 3rd heating, water is removed from the sample using heat. The 4th heating is very close in value to the 3rd which indicates that it should have been the last heating (which the student should have stopped). The 5th and 6th heating indicate that the sample has been burnt and the black spots on the dehydrated sample cause the mass to increase, which makes the reading to be inaccurate for the sample

*5. Briefly, what effect would spattering onto the side of the lid during heating have on the water lost and calculated formula for the original hydrate?*

Spattering can cause water to remain within the crucible instead of escaping through the small gap between the base of the crucible and the lid. Instead of having the water escaped, spattering will cause water to remain condensed on the lid; therefore, the calculated water loss will not be accurate. The calculated formula may not be accurate either because spattering not only causes water to remain in the sample, but also the loss of the solid in the sample.