Name:
The Determination of the Percent Water in a Compound and the Empirical Formula of a Salt

The polarity of the water molecule, which makes it a great solvent for ionic compounds, causes water molecules to cling to the structure of solid substances. When this occurs, the trapped water molecules are called water of hydration and they become an integral part of the crystal structure.

There are many compounds that have a tendency to absorb water vapor from the air. These compounds are said to be *hygroscopic*, and can be used as moisture-reducing agents. Other compounds absorb such large quantities of water vapor that they will actually dissolve in their own water of hydration, a property known as *deliquescence*.

In this experiment, you will test a hygroscopic ionic compound to determine its water of hydration. Although the water molecules are securely attached to the ionic solid that you will test, they are susceptible to removal by heat. You will gently heat a sample of the compound to drive off the water of hydration. By measuring the mass of the sample before and after heating, you can determine the amount of water in the sample and calculate its water of hydration.

OBJECTIVES

In this experiment, you will

- Determine the % water by mass of the ionic salt.

** NOTE: YOU MUST HAVE THIS CALCULATION COMPLETED BEFORE YOU LEAVE LAB**

MATERIALS

crucible
crucible tongs
spatula
ring stand, ring, and clay triangle
lab burner

Chemical to be used
copper (II) sulfate, $CuSO_4 \cdot nH_2O$
desiccator
balance

PROCEDURE

1. Obtain and wear goggles.

2. Measure and record the mass of a clean, dry crucible. Obtain about 1-1.5 g of the selected compound and place it in the crucible. Measure and record the mass of the crucible and compound.

3. Set up a ring stand, ring, and clay triangle for heating the sample. Rest the crucible on the clay triangle. Set up a lab burner and ignite the burner away from the crucible.

4. Gently heat the crucible for about 5 minutes. Depending on the compound that you selected, the color of the sample may change significantly as the water of hydration is driven out of the crystals.

5. Turn off the burner. When the crucible is cool enough to handle safely, measure and record the mass of the crucible and contents.

7. Heat the crucible of your sample for 5 more minutes, allow it to cool, and measure and record its mass.

8. If there is a large difference between the weights you may heat again. Note: We are trying to drive all the water out of this sample. If the weight does not change appreciably then all the water weight has been driven out.

9. Dispose of your sample as directed. This substance can be thrown in to the garbage can. Wait until the sample is cool to the touch before putting in **garbage can**. Do not drop crucible into garbage can. Crucible costs $7.50

DATA TABLE (Put Data in Data Section of lab)

Compound selected for analysis	
Mass of crucible (g)	
Mass of crucible and hydrated sample (g)	
Mass of hydrated sample (g)	
Mass of crucible and dehydrated sample – 1st weighing (g)	
Mass of crucible and dehydrated sample – 2nd weighing (g)	
Mass of crucible and dehydrated sample – 3rd weighing (g)(Optional)	
Mass of dehydrated sample (g)	
Mass of water evolved (g)	
Moles of water evolved	
Moles of dried compound	

DATA ANALYSIS

1. What is the percent mass of water in the compound?

2. How many moles of water were in your sample?

3. How many moles of dry compound are present after heating.

4. What is the proper chemical formula and name for the compound that you tested? In other words, what is "n". Determine the mole ratio of dry compound to water. Example if there was .5 moles of dry compound and 1.5 moles of water the ratio would be 1:3 and "n" would be 3. (Dividing moles of water by moles of $CuSO_4$ will give you the ratio) Show your calculations.

5. If you had not heated the sample long enough to remove all the water of hydration, how would your subsequent calculations affected the chemical formula or "n"? Explain!