Hydrate Lab

Objective: The objective of this experiment is to determine the number of moles of water attached to one mole of copper sulfate, in the hydrate $CuSO_4 * XH_2O$.

Theory: When ionic solids crystallize from aqueous solutions, they combine with a certain amount of water, which becomes part of the crystalline solid. Salts that contain water as part of their crystal structure are called *hydrates.* The water portion of a hydrate is specifically called the *water of hydration.* When the water of hydration is removed from the hydrate, the salt that remains is said to be *anhydrous* (without water).

In this experiment, you will remove the water from a known mass of hydrated copper sulfate by heating the compound.

$$\underset{\text{(Hydrate)}}{CuSO_4 * XH_2O} \rightarrow \underset{\text{(Anhydrous Salt)}}{CuSO_4} + \underset{\text{(water)}}{XH_2O}$$

Through this experiment, you will determine the percent composition of water in Copper (II) Sulfate, as well as determine how many moles of water are attached to one mole of Copper (II) Sulfate.

Procedures:

1. Obtain a beaker from your drawer (at least 100 mL) and determine its mass.
2. Measure out approximately 1 g of the hydrated Copper (II) Sulfate.
3. Place this sample into your beaker and determine its mass.
4. Place your beaker with hydrate on hot plate and heat until the hydrate has turned *completely* white.
5. Continue heating for an additional 3 minutes after the hydrate has turned white.
6. *Carefully* remove the beaker from the heat source and let cool for 2 minutes.
7. Determine the mass of your beaker and your anhydrous salt.
8. Once you have taken your mass, add a little bit of water to your anhydrous salt (enough to cover the crystals). Record your observations.
9. Pour the dissolved hydrate into the specified container.

Observations: In this lab, I will want **<u>TWO</u>** sets of observations:

1. Quantitative: Masses of hydrate (blue crystal), anhydrous salt (white powder), water, etc. (this should be represented in a data table. You will need to get data from ALL other groups to include in your data table).
2. Qualitative: What happened during heating? After adding water? Etc.

Calculations:

1. Calculate the mass of water lost from your hydrate (subtract the mass of the white powder from the mass of the blue crystal)
2. Calculate the percent composition of water in your hydrate. (divide the mass of water (answer to number 1) by the mass of the hydrate (blue crystal) then multiply by 100)
3. Calculate the number of moles of water lost. (use the molar mass to convert your grams of water (answer to number 1) to moles – you will be dividing your grams found by the mass of water)
4. Calculate the number of moles of anhydrous salt. (use the molar mass to convert your grams of $CuSO_4$ (mass of white crystal) to moles – you will be dividing your grams found by the mass of $CuSO_4$)
5. Calculate the number of moles of water lost for every mole of anhydrous salt (mol_{water} / $mol_{anhydrous\ salt}$) (Round this number to the next WHOLE number) (divide the answer to step 3 by the answer to step 4)
6. The above calculation (step 5) gives the value of "X" in $CuSO_4 * XH_2O$. Write the correct formula for the hydrate.
7. What is the name of this hydrate?
8. What happened when you added water at the end? Why did this happen?