Name: _____
Partner(s): _____
Period: _____ Date: _____

CP Chemistry Lab – Formula of a Hydrate

Introduction:

A **hydrate** is a chemical that has water molecules loosely bonded to it. The water molecules are not actually part of the formula, so the formula is written slightly differently. Here are some examples of hydrates:

$CaSO_4 \bullet 2H_2O$ $MgSO_4 \bullet 7H_2O$ $CoCl_2 \bullet 6H_2O$

The water can easily be removed from a hydrate just by heating strongly. This will cause the water to evaporate leaving you with an **anhydrate**. You will be weighing a hydrated sample. The sample will be heated and then weighed again to find the mass of anhydrate and mass of water lost. You can now find the percent composition of the anhydrate and the water in the total hydrate. We can use grams to find a mole ratio which can help us determine how many moles of water there are per mole of anhydrate.

You will be using the hydrate $CuSO_4 \bullet ?\ H_2O$

Pre-Lab Questions:

1. What is a hydrate?

2. How will the water be removed from the hydrate in this experiment?

3. What is the percent of water in a sample of the hydrate, $MgSO_4 \bullet 7H_2O$?

Materials:

safety goggles	striker	crucible tongs
apron	ring stand with iron ring	Bunsen burner
crucible	clay triangle	hydrate crystals ($CuSO_4 \bullet ?H_2O$)

Safety:

Wear safety glasses at all times.
Do not touch a hot crucible with your hands.
DO NOT weigh a crucible that is still hot.

Procedure:

Place a check mark on the line as you complete each step!

_____ 1. Obtain a clean crucible and lid. Use the balance to find their mass and record in data table (a).

_____ 2. Set up a ring stand and place a clay triangle on the iron ring. Place the crucible inside the triangle with the Bunsen burner below. Adjust the height of the iron ring if necessary. It should be 3-4 inches above the Bunsen burner.

_____ 3. Place a scoop of the unknown hydrate crystals into the crucible. Weigh the entire sample and record the mass in the data table (b).

_____ 4. Look the hydrated compound and write your observations in the data section.

_____ 5. Return the crucible with hydrate to the clay triangle. Remove the lid and place it off to the side.

_____ 6. Move the Bunsen burner from underneath the crucible. Light and adjust the flame.

_____ 7. Return adjusted flame to underneath crucible. Adjust so that the crucible rests where the 2 cones meet. Heat the crucible for 8-10 minutes.

_____ 8. Turn off the flame. Use the tongs to remove the crucible and set it on the base of the ring stand. Place the lid on top. Allow the crucible to **cool** completely. Find the mass and record this in your data table (d).

_____ 9. Observe the compound after heating and write your observations in the data section.

_____ 10. Place the anhydrate in the waste beaker provided by the teacher.

_____ 11. Return all equipment to proper location. Wipe down lab stations and was hands thoroughly before leaving the laboratory.

Data:

Observations of hydrated compound **before** heating: _____

_____

Observations of compound **after** heating: _____

_____

a) Mass of empty crucible and lid _____ g
b) Mass of crucible, lid, and hydrate _____ g
c) Mass of hydrate only (b minus a) _____ g
d) Mass of crucible, lid, and compound after heating _____ g
e) Mass of anhydrate only (d minus a) _____ g
f) Mass of water (c minus e) _____ g

Post-Lab Analysis and Conclusions:

1. Determine the percentage of water in the hydrate. Remember that (c) is the mass of the whole hydrate and (f) is how much water is in there.

2. Follow the empirical formula steps below to determine the formula for your hydrate:
   a. Convert your mass of $CuSO_4$ anhydrate (e) and mass of H_2O lost (f) to moles.

   b. Divide by the smallest number of moles

   c. Write the formula of your hydrate. (Refer back to the front to see how hydrates are written)

3. Calculate the percent error for the moles of water in your experiment. The amount of moles of water in #2c is the experimental value. The actual formula of the hydrate is $CuSO_4 \cdot \mathbf{5}\ H_2O$.

$$Percent\ error = \left|\frac{actual - experimental}{actual}\right| x\ 100$$

4. Why should the crucible and contents be cooled before finding the mass?

5. What do you think are possible sources of error in the laboratory exercise? Explain.

6. Packets of anhydrous compounds are sometimes used to keep basements from being damp. Is there a limit to how long the packet can be used? Why or why not?