

HYDRATE LAB

PURPOSE

The objective of this experiment is to determine the number of moles of water associated with one mole of copper sulfate, in the hydrate $CuSO_4 \cdot xH_2O(s)$.

THEORY

When certain ionic solids crystallize from aqueous solutions, they combine with a definite amount of water, which becomes a part of the crystalline solid. Salts that contain water as part of their crystal structure are called *hydrates* (or *hydrated salts*) and the water in the crystal structure is called the *water of hydration*. When the water of hydration is removed from the hydrate, the salt that remains is said to be *anhydrous*.

In this experiment you will remove the water of hydration from a known mass of hydrated copper sulfate by heating the compound in a crucible: $CuSO_4 \cdot xH_2O(s) \xrightarrow{heat} CuSO_4(s) + xH_2O(g)$ hydrated salt anhydrous salt water

By knowing the mass of the anhydrous salt and the mass of water driven off through heating, the formula of the hydrate can be determined.

<u>APPARATUS</u>

- Crucible
- Ring clamp
- Bunsen burner
- Balance (with thermal pad)

- Retort stand
- Clay triangle
- Crucible tongs

PROCEDURE

Protective eyewear <u>must</u> be worn during this lab. As much as possible, handle your crucible with tongs.

- 1. Set up your retort stand with a ring clamp and clay triangle. Obtain a crucible. Clean it out with a dry paper towel if necessary. Place the crucible in the clay triangle. Light your Bunsen burner.
- 2. Heat the crucible strongly for one minute. Allow it to *cool to room temperature*.
- 3. Weight the crucible (don't forget to press "tare" first). Record the mass in the appropriate space below.
- 4. Place a 2 3 g sample (one spoonful) of the powdered hydrate into the crucible. Immediately measure the mass of the crucible containing the hydrate. Record your value in the space below.
- 5. <u>Gently</u> heat the crucible. If the temperature is too high, crystals of hydrated salt may pop or spatter. If this happens, decrease the flame's intensity. During heating, the edges of the sample should slowly turn white as water leaves the hydrate. After 2 minutes, increase the intensity of the flame <u>slightly</u>. Heat the sample with this medium intensity flame until the blue colour <u>completely</u> disappears (≈ 4 min.).
- 6. Allow the crucible to cool for 2 minutes. Weigh the crucible containing the anhydrous salt. Record.
- 7. Dump the used CuSO₄ onto a paper towel. Add a few drops of water. Record your observations.
- 8. Clean up (note: use a *dry* paper towel to clean your crucible). The used CuSO₄ can go in the garbage.

_		water lost	g
	crucible and anhydrous salt g	anhydrous salt	g
crucibleg	crucible and hydrate g	hydrate	g
DATA SUMMARY (spaces	s that require calculations appear in bold type)		

CALCULATIONS AND QUESTIONS

- 1. Calculate the number of moles of water lost (molwater).
- 2. Calculate the number of moles of anhydrous salt (molanhydrous salt)
- 3. Calculate the number of moles of water lost for every mole of anhydrous salt (mol water ÷ mol anhydrous salt).

- 4. The above calculation gives the value of x in $CuSO_4 \cdot xH_2O(s)$. Write the correct formula for the hydrate.
- 5. What is the IUPAC name given to this hydrate?
 What happened to the colour of the product when you added water? What does this indicate?