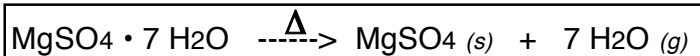


Formula of a Hydrate Lab

Name: _____

The purpose of this lab is to determine the percent by mass of water in hydrated copper(II) sulfate, and to establish the formula for the salt. Many salts occurring in nature (or even purchased from chemical suppliers!) are *hydrated*; that is, a number of water molecules are bound to the ions in the crystalline structure of the salt. For many of these hydrated salts, such as Epsom salt, heat removes the water molecules:

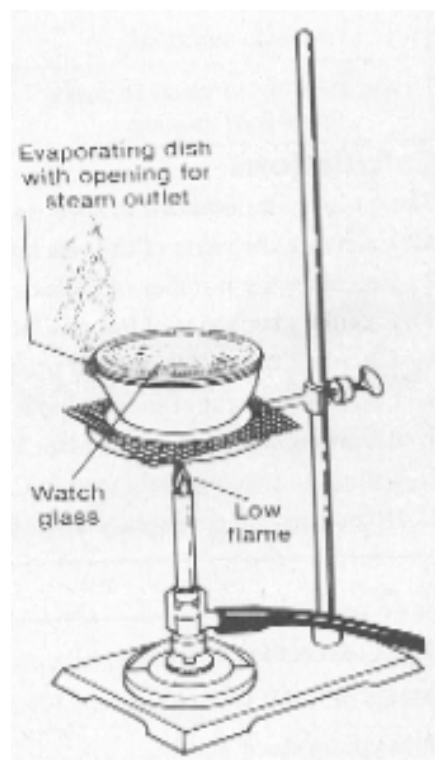


In Epsom salt (magnesium sulfate heptahydrate), the percent by mass in the hydrated salt is:

$$\frac{7 \text{H}_2\text{O}}{\text{MgSO}_4 \cdot 7 \text{H}_2\text{O}} \times 100 = \frac{126.14 \text{ g}}{120.37 \text{ g} + 126.14 \text{ g}} \times 100 = \text{51.170\% H}_2\text{O}$$

Procedure:

1. Record the mass of evaporating dish + watch glass. Add ca. 5 g of copper(II) sulfate (?) -hydrate to the dish. Record the total mass.
2. Place the dish on the clay triangle & cover as shown: Heat the dish gently w/ a low flame, then gradually intensify the heat over a few minutes. Do not allow the dish to become red hot. Continue to heat for 12 minutes. Turn off the gas, and **carefully** use tongs to remove the watch glass and the dish from the triangle. Set on lab bench to cool for 5 minutes.
3. Reweigh the the lid + dish + salt.
4. The anhydrous copper(II) sulfate can be washed down the sink. (notice what happens to the color when water is added back to it!?) Wash the dish & clean-up your lab area.



Data:

mass of dish and lid _____
mass of dish, lid, & hydrated salt _____
mass of dish, lid, and anhydrous salt _____

Calculations:

- a) mass of anhydrous salt _____
b) mass of hydrated salt _____
c) mass of water lost _____ (b - a)
d) % mass of water in hydrate _____ (c ÷ b x 100)
e) formula weight of anhydrous salt _____
f) formula weight of water _____
g) moles of anhydrous salt _____ (a ÷ e)
h) moles of water lost _____ (c ÷ f)
i) mole ratio of water to anhydrous salt _____ (h ÷ g) round to whole #
j) **formula of hydrate:** _____

(continued on back.....)

Questions

1. A student heats a salt weighing 3.40 grams. After heating, it weighs 3.05 grams. Could this salt be a hydrate? What evidence supports your answer? Talk chemistry
2. When you heated the salt in the lab, was this a physical change or a chemical change? What evidence supports your answer?
3. A student heats 4.20 g of nickel(II) acetate (?) -hydrate [$\text{Ni}(\text{C}_2\text{H}_3\text{O}_2)_2 \cdot ? \text{H}_2\text{O}$]. After heating, the anhydrous salt weighs 2.98 g. What is the formula for the hydrate?
4. A student heats 4.20 g of calcium sulfate (?) -hydrate. After heating, the anhydrous salt weighs 3.94 g. What is the formula for the hydrate?
5. What was the purpose of the watch-glass over the crucible?
6. Consider the following sources of error. Determine if they would make your mole-ratio come out too **<H>igh**, too **<L>ow**, or **<N>o** Effect...
 - ___ the Bunsen burner had left black soot on the bottom of the crucible
 - ___ the copper(II) sulfate wasn't completely anhydrous after heating
 - ___ some of the salt splattered out during heating while you weren't watching
 - ___ your watch-glass weighed more than everyone else's
 - ___ you incorrectly thought the formula for copper(II) sulfate was Cu_2SO_4