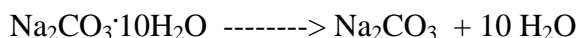


Formula of a Hydrate

Purpose: To determine the percent by weight of water hydrated to a salt.
To establish for formula of a hydrated salt.

Principles:

Many salts occurring in nature or 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. The number of moles of water per mole of a particular hydrated salt is usually a constant. For example, ferric chloride is purchased as $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$, not as FeCl_3 . For some salts, heat removes these water molecules:



Where as in others, they cannot be removed, no matter how intense the heat, e.g., $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$.

In sodium carbonate decahydrate, 10 moles of water molecules are bound to each mole of Na_2CO_3 or 180.20 g of H_2O per 105.99 g of Na_2CO_3 . The percent H_2O in the hydrated salt is

$$\frac{180.20 \text{ g}}{180.20 \text{ g} + 105.99 \text{ g}} \times 100\% = 62.97\% \text{H}_2\text{O}$$

This experiment determines the percent by weight of water in a hydrated salt and its formula.

Procedure:

Completion of at least 3 trials is suggested for this experiment.

1. Support a clean crucible and lid on a clay triangle and heat with an intense flame for 5 minutes. Allow it to cool. If the crucible is very dirty, add a few milliliters of 6 M HNO_3 . (*CAUTION: Avoid skin contact, flush immediately with water*) and evaporate to dryness. Weigh the fired crucible and lid. Handle the crucible and lid with the crucible tongs for the rest of the experiment; **do not** use your fingers.

2. Add at most 3 g of an unknown hydrate to the crucible and weight it, the lid, and the sample.

3. Return the crucible with the sample to the clay triangle and set the lid off the crucible's edge to allow evolved gases to escape.

4. At first, heat the sample slowly and then gradually intensify the heat. Do not allow the crucible to become red-hot. This could cause the anhydrous (dried) salt to decompose. Heat the sample for 15 minutes. Cover the crucible with the lid, cool to room temperature, and weight it, the lid, and the sample.

5. Reheat the sample for 5 minutes. Reweigh it. If the second weighing disagrees by anything over 2% with the first, repeat the heating until a constant weight is achieved.

Data

Name of the salt _____

	<u>Trial 1</u>	<u>Trial 2</u>	<u>Trial 3</u>
1. Mass of crucible and lid	_____	_____	_____
2. Mass of crucible, lid and hydrated salt	_____	_____	_____
3. Mass of crucible, lid, and anhydrous salt			
1st weighing	_____	_____	_____
2nd weighing	_____	_____	_____
3rd weighing	_____	_____	_____

Calculations:**Show work –Do not just fill in the table**

1. Mass of hydrated salt	_____	_____	_____
2. Mass of anhydrous salt	_____	_____	_____
3. Moles of anhydrous salt	_____	_____	_____
4. Mass of water lost	_____	_____	_____
5. Moles of water lost	_____	_____	_____
6. Percent by mass of volatile water in this hydrated salt	_____	_____	_____
7. Average % H ₂ O in hydrated salt	_____		
8. Mole ratio of anhydrous salt to water. (Rounded to 1/10's)	_____	_____	_____
9. Formula of the hydrate	_____		

Conclusion:

Write up a conclusion using the correct format and addressing all aspects described in the Rubric.

