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Title: Determination of Waters of Hydration Lab Report

Statement of Purpose

To determine the mass percent of water and number of water molecules in a hydrated ionic compound.

Background

Waters of Hydration is known as water that is chemically combined with a substance to form a hydrate. It can be expelled with the action of heating, without taking away the composition of the substance. An ionic compound is a chemical compound made up of ions that are held together by electrostatic forces also known as ionic bonding. Examples of these are Sodium chloride, Calcium chloride, Sodium fluoride, and Sodium hydroxide. Many ionic compounds have the characteristic of being able to combine with water, those that are able to do this are called hydrates. Another example would be Zinc sulphate which when combined with water it forms crystalline. This substance remains stable under normal atmospheric conditions, and all samples of the Zinc sulphate shows the same percentage of water. When heating a sample of a hydrate it may lose all its water of hydration, causing it to change to an anhydrous compound which the original compound with no hydration present. When carrying out this experiment the wearing of eye protection must be used, and the crucible gets very hot and can burn the hands when touched.

Procedures

Clean and dry a porcelain crucible and cover. Place an empty, covered crucible on a triangle holder and heat it until a redness appears. Leave the crucible to cool to room temperature and weigh it to the nearest 0.01 gram. As the first crucible is cooling, use a second crucible and repeat the same procedures. Obtain a sample of an unknown hydrate from the instructor and add about 2.0- 2.20 grams of the hydrate given to the crucible and weigh the covered crucible with the sample to the same accuracy as previously. Then record the weights recorded in a data sheet.

After this then place the covered crucible with the sample on the triangle and heat gently for a few minutes. Heat the material gently so that there is no loss of the substance through splattering during the initial heating. Continue to heat for 15 minutes with the hottest part of the burner flame, and allow the covered crucible to cool until it reached room temperature. Now weigh the covered crucible and residue, then reheat the crucible for 5 minutes, cool and reweigh. Continue to do this until two consecutive weightings are the same within 0.01 gram. As the first crucible with sample is cooling, repeat the process with a second sample of the hydrate, and run the experiment simultaneously.

Data

The materials that were used in the experiment were Crucibles with covers, Triangular holder, Bunsen burner, Ring stand, Balance, Tongs, and Mesh pad. The table below shows the data that was found during the experiment:

Data Section

	Sample 1	Sample 2
1. Mass of crucible and cover	36.1571g	36.1605g
2. Mass of crucible, cover and sample	38.189 g	38.1655 g
3. Mass of hydrated compound (2-1)	2.1614 g	2.1524 g
4. Mass of crucible, cover and anhydrous salt	37.3005g	37.2981g
5. Mass of anhydrous salt (4-1)	1.1434g	1.1398g
6. Mass of water lost (3-5)	1.018g	1.016g
7. Percentage of water ($\frac{6}{3} \times 100\%$)	-----g	-----g
8. Moles of water = (number 6/18 g/mole)	-----mol	-----mol
9. Molar mass of anhydrous compound (C)	-----g/mol	-----g/mol

10. Moles of anhydrous compound = (5/9) -----mol -----mol

11. Waters of Hydration (n)= (8/10) ----- -----

After the experiment is completed the following blanks will be filled with data.

Results and Data Treatment

The table below shows the results from the experiment that was carried out:

Data Section

	Sample 1	Sample 2
1. Mass of crucible and cover	36.1571g	36.1605g
2. Mass of crucible, cover and sample	38.189 g	38.1655 g
3. Mass of hydrated compound (2-1)	2.1614 g	2.1524 g
4. Mass of crucible, cover and anhydrous salt	37.3005g	37.2981g
5. Mass of anhydrous salt (4-1)	1.1434g	1.1398g
6. Mass of water lost (3-5)	1.018g	1.016g
7. Percentage of water (6/3 x 100%)	47.099g	47.203g

8. Moles of water = (number 6/18 g/mole)	0.0565mol	0.0564mol
9. Molar mass of anhydrous compound (C)	161g/mol	161g/mol
10. Moles of anhydrous compound = (5/9)	0.0071018mol	0.0070950mol
11. Waters of Hydration (n)= (8/10)	0.00565	0.00564

Discussion and Conclusion

Waters of Hydration is known as water that is chemically combined with a substance to form a hydrate. It can be expelled with the action of heating, without taking away the composition of the substance. This experiment shows that the percentage of water in a hydrate and calculating this information, is determined by the known mass of the hydrated salt was heated, evaporating the water. Now that the mass of the hydrate is known, the mass of the of the water that was lost is known. By comparing the mass lost to the mass of the salt left behind, the percentage of the water can be calculated. Errors that could have occurred are the substance could have been exposed to air before measurements were taken, and reabsorption of moisture could have occurred which would give an inaccurate measure. Not all the water could have been removed during the heating process. Also, human errors could have just occurred such as the individual performing the lab could have measured something inaccurate, the equipment could have been faulty, also someone could have thought a measurement was something else these could have contributed to errors. Improvements that could be taken towards the experiment are the sample substance could have been more for more accurate measurement. More accurate equipment to help with accurate results. The use of a larger crucible to reduce the event of more

spatter happening. In conclusion, although all of these mistakes could have been made, the lab still ran smooth and there were little errors done in the process.