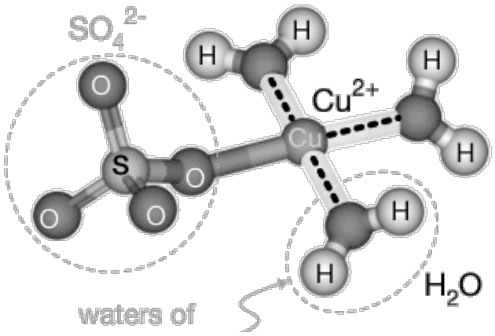
Name _____ Period _____

Chemistry of the Earth Lab 7 – Decomposition of a Hydrate 60 Points

Lab Introduction

A hydrate is an ionic compound that contains water molecules surrounding the compound's ionic structure. The water molecule role is to provide additional stability to the ionic crystal structure through the use of hydrogen bonding's increased stability to lower the bond energy of the entire crystal structure.



The water molecule is polar, or has one end (*Oxygen, O*) that receives electrons more often than the other side (*Hydrogen, H*), making the oxygen side appear more negative than the hydrogen side. This negative and positive end of the water molecule will therefore be attracted to the positive and negative ends of an ionic compound, forming an ionic like bond. In addition, hydrogen bonding, or the attraction of the positive hydrogens to other elements, such as the oxygen of other molecules, acts like a weak ionic bond providing additional stability in the overall ionic crystal structure.

The molar ratio of water to the anhydrous (*without water*) ionic compound and water can be found by using a dehydration process shown below

$MgCl_2 \bullet 6H_2O \rightarrow MgCl_2 + 6H_2O$ Mol Ratio - 1mol MgCl : 6mol H_2O

By heating a sample until the water boils off under a constant heat (*Bunsen burner or hot plate*), the salt can be made *anhydrous*. The difference between the original and anhydrous mass of the ionic salt is then used to find the mass of the water.

$$\text{Mass } H_2O = (\text{Mass } MgCl_2 \bullet 6H_2O) - (\text{Mass } MgCl_2)$$

Converting the mass of both the water (*H_2O*) and anhydrous salt (*$MgCl_2$*) to mol we can find the mol ratio of the two molecules/compounds.

$$\text{Mol Ratio} = \text{Mol } H_2O / \text{Mol } MgCl_2 \quad [\text{Water / Anhydrous Salt}]$$

The answer to this equation is the mol ratio, the ratio of the water to the anhydrous salt seen in the equation of the hydrate.

Safety Precautions

1. Hot plates, beakers after heating, and the ionic (*salt*) compounds are hot even if they look cool to the touch. Use beaker tongs to handle all suspected hot glassware.
2. Do not place hot glassware directly on the countertop. Doing so will break the glassware. If glassware breaks notify instructor.
3. Due to the risk of splashing and the risk of Copper(II)Sulfate getting into the eyes googles must be worn while any samples are heat on the Bunsen Burner/Hot Plate.

Procedure

1. Weight the mass of two small beakers (*50 – 100mL*), one for sample A and one for sample B. Record those masses on the data table;
2. Turn on the Hot Plate and allow to heat up for 5 – 10 minutes while doing the other steps;
3. Add the ionic salt from the weighing boat to the beaker, then weight the beaker. This mass is the mass of the beaker and salt. Record this value on the data table (*Starting mass with beaker*);
4. Place both beakers on the hot plate and allow the salts to heat for 5 – 10minutes. You can stop heating once no more steam comes off of the salt, the color has changed completely, or 10 minutes have passed;
5. Cool the beakers then record the final mass of the beaker + the anhydrous salt. Record answer on the data table;
6. Turn off the hot plate, allow the beakers to completely cool, then rinse out both beakers in the sink to clean.

Data Table

Hydrated Salt	Hydrated Salt Formula	Beaker Mass (*g*)	Starting Mass (*g*)	Final Mass (*g*)	Mass of Water (*g*)
A	$CuSO_4 \cdot \_\_\_\_ H_2O$				
B	$Na_2S_2O_3 \cdot \_\_\_\_ H_2O$				

Starting Mass = Mass on Balance – Beaker Mass
Dehydrated Mass = Mass on Balance after heating – Crucible Mass
Mass of Water = Starting Mass – Dehydrated Mass

Calculations and Results

Mol Anhydrous (*after heating*) Salt		Mol Water (H_2O) Removed	
A	*Molar Mass $CuSO_4$ = 159.62g/mol*	A	*Molar Mass H_2O = 18.02g/mol*
B	*Molar Mass $Na_2S_3O_2$ = 174.19g/mol*	B	*Molar Mass H_2O = 18.02g/mol*

Mol Ratio A (*Mol $CuSO_4$ / Mol H_2O*)		Mol Ratio B (*Mol $Na_2S_3O_{2=}$ / Mol H_2O*)	
A		B	

Hydrated Salt	Hydrated Salt Formula	Mol Dehydrated Salt	Mol Water	Mol Ratio
A	$CuSO_4 \cdot \_\_\_\_ H_2O$			
B	$Na_2S_2O_3 \cdot \_\_\_\_ H_2O$			