Hydrated Compounds ...

Hydrates ...

There are many ionic compounds that have water molecules adhering to their strucutres and becoming part of the molecule. These **hydrates**, as they are called, usually contain a specific mole ratio of water to compound. Formulas for hydrated compounds place the water of hydration following a dot after the regular formula. For example, $CuSO_4 \cdot 5H_2O$ is the formula for a hydrate of copper (II) sulfate. The name of the compound is copper (II) sulfate pentahydrate. Such compounds are named just as regular compounds except that the number of water molecules is included. The regular name is followed by the word hydrate to which a prefix has been added to indicate the relative molar proportions of water and compound.

To analyze hydrates, the compound can be dried by heating to drive off the water. The loss in mass can be measured to determine the amount of water present. The dry compound remaining after driving off the water is called **anhydrous**, meaning "without water." By knowing the mass of the anhydrous compound, along with the mass of water, the mole ratio between them can be calculated.

Sample Calculations ...

Imagine a 10.407 g sample of hydrated barium iodide. The sample is heated to drive off the water. The dry sample (anhydrous) has a mass of 9.520 g. What is the mole ratio between barium iodide, BaI_2, and water, H_2O? What is the formula for the hydrate?

The difference between the initial mass and that of the dry sample is the mass of water that was driven off.

Mass of hydrate	10.407 g
Mass of dry sample	-9.520 g
Mass of water	0.887 g

The mass of water and mass of dry BaI_2 are converted to moles.

$$9.520 \text{ g } BaI_2 \left| \frac{1 \text{ mole } BaI_2}{391 \text{ g } BaI_2} \right. = 0.0243 \text{ mole } BaI_2$$

$$0.887 \text{ g } H_2O \left| \frac{1 \text{ mole } H_2O}{18.0 \text{ g } H_2O} \right. = 0.0493 \text{ mole } H_2O$$

Dividing both results by the smallest number of moles, 0.0243 mole, we obtain a ratio of 1 to 2.03 or 1:2. Thus, for every 1 mole of BaI_2, there are 2 moles of H_2O. The formula for the hydrate is written as $BaI_2 \cdot 2H_2O$.

Name: Key Period: _____ Date: _____

Practice Problems … write the formula of each hydrate! (HINT: Find the mole ratio between the anhydrous part and the water part)

1. 0.391 g Li_2SiF_6, 0.0903 g H_2O — $Li_2SiF_6 \cdot 2H_2O$

2. 0.737 g $MgSO_3$, 0.763 g H_2O — $MgSO_3 \cdot 6H_2O$

104.4 18.0
moles .007059/1 .0424/6

3. 37.1% Na_2CO_3, 62.9% H_2O — $Na_2CO_3 \cdot 10H_2O$

106.0 18.0
moles .3500/1 3.49/10

4. 48.8% $MgSO_4$, 51.2% H_2O — $MgSO_4 \cdot 7H_2O$

120.4 18.0
moles .4055/1 2.844/7

2) Mg 24.3
S 32.1
(3)O 48.0
104.4

3) (2)N_2 46.0
C 12.0
(3)O 48.0
106.0

4) Mg 24.3
S 32.1
(4)O 64.0
120.4