**Hydrates**

Hydrates: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\*water is trapped in the salt crystal lattice of the compound.

(Common examples: MgSO4 7H2O = Epsom Salt, Na2CO3 10H2O = washing soda (crystals)

Naming and recognizing hydrates:

 -First, name the SALT (ionic) compound. This will be on the LEFT of the dot.

-Then, determine how many water molecules are present. Use molecular prefixes to indicate the number of water molecules I the hydrate. (Write as: prefix-hydrate)

Ex: CaCl2 2H2O = calcium chloride dihydrate MnSO3 H2O = manganese (II) sulfite monohydrate

Ex: ZnSO4 7H2O = FeCl3 6H2O =

\*Be able to write hydrate formula and give molar mass!

Ex: Copper (II) sulfate pentahydrate Ex: calcium nitrate hexahydrate

 Formula: Formula:

 Molar Mass: Molar Mass:

\*Remember: hydrate means that there is WATER PRESENT in the compound!

The salt without water is considered the ANHYDROUS COMPOUND or ANHYDRATE

Anhydrate: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The process that removes water from the hydrate by heat is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Percent composition = part x 100

 Whole

Steps to finding % composition:

 1. Determine what part (salt or water) the question is asking for?

 2. Find the molar mass of the entire hydrate compound. This is the WHOLE.

 3. Plug numbers into the formula above, then solve!

Ex 1: Calculate the % of water in sodium carbonate decahydrate, Na2CO3 10H2O.

Ex 2: What percentage of the anhydrous salt in magnesium chloride hexahydrate, MgCl2 6H2O?

Ex 3: A 5.0 gram sample of a hydrate of BaCl2 was heated, and only 4.3 grams of the anhydrous salt remained. What % of water was in the hydrate?

Ex 4: If 125 grams of magnesium sulfate heptahydrate is completely dehydrated, how many grams of anhydrate magnesium sulfate salt will remain?

 \* 2-Step problem:

 -First, find the % composition of the anhydrous salt,

 -then, multiply the percentage (in decimal form) with total mass!

Be able to construct the entire hydrate formula given only masses or percentage!

Use the following steps to do so:

1. Convert mass (in grams) of water AND anhydrous salt to moles (in mol).
2. Use the following formula to determine the # of water molecule in the compound:

$$ n=\frac{mol of WATER}{mol of anhydrous SALT}$$

Ex 5: A 5.0 gram sample of Cu(NO3)2  ***n*** H2O is heated, 3.9 grams of the anhydrous salt remains. What is the value of n?

Ex 6: Borax has the formula Na2B4O7 ***n*** H2O (sodium tetraborate n-hydrate). The percent composition of this hydrate is 52.8% sodium tetraborate and 47.2% water. What is the complete and correct formula for this hydrate?

**HOMEWORK: Hydrates**

1. Name the following hydrates:

1. FeSO4 3H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 3.NaCl8H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

2. Cd3(PO4)2 H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 4.CoBr2 5H2O \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write formula and determine the molar mass for the following hydrates:

5. Calcium sulfate dihydrate: 6. Calcium sulfate dihydrate:

Formula: Formula:

Molar Mass: Molar Mass:

1. Determine the % composition in the following problems:

7. What is the % of water in CuCl3 3H2O?

8. Calculate the % of the anhydrous salt in Cr2SO4 9H2O.

9. A 7.75 gram sample of hydrate MgCl2 was heated, and only 4.50 grams of the anhydrous salt remained. What % of water was in the hydrate?

10. If 145 grams of copper (II) sulfate pentahydrate is completely dehydrated, how many grams of the anhydrous copper (II) sulfate will remain? \*HINT: 2 –step problem!

1. Determine the formula for the hydrates below given either masses or percentage. Remember to use formula $ n=\frac{mol of WATER}{mol of anhydrous SALT}$**.**

11. A 15.67 g sample of a hydrate of magnesium carbonate was heated, to drive off the water. The mass was reduced to 7.58 g. What is the formula of this hydrate?

12. Magnesium sulfate hydrate, MgSO4  ***n*** H2O, contains 51.1% water and 48.9% magnesium sulfate. Calculate the value of “*n.*”