SC2 b, c, d 

Mole Lab #5: FORMULA OF A HYDRATE

INTRODUCTION:

The strong dipole of water, which causes it to be an excellent solvent for ionic substances, also causes water molecules to attach themselves to ions in solution. Such ions are called **Hydrated ions**. When some solutions of hydrated ions are evaporated, the water molecules are so strongly attracted to the ions in solution that they remain attached as crystallization occurs. Water molecules are incorporated into the crystal structure. This water is called **water of hydration**.

Crystals that have formed in this way appear to be perfectly dry, yet when heated yield large quantities of water. The crystals change form, sometimes, even color, as the water is driven off. This indicates that the water was present as an integral part of the crystal structure. Such compounds are called **hydrates**. The number of moles of water present per mole of anhydrous salt is usually some simple number (whole-number).

In this experiment you will be given an appropriate hydrate selected by your teacher. You will find the mass of water driven off by heating and the amount of anhydrous salt that remains. Your teacher will give you the formula of the anhydrous salt so you can find the **empirical formula** of the hydrate.

MATERIALS:

- Safety goggles
- Crucible and cover
- Clay triangle
- Assigned hydrate
- Crucible tongs
- Ring stand with ring
- Burner
- Desiccators (if needed)

PROCEDURE:

- **PRE-LAB – Must be completed before you perform experiment**

1) What is an anhydrous salt? If the formula of a hydrate is $BaSO_4 \cdot 8H_2O$, what is the formula of the anhydrous salt?

2) Record on your **DATA TABLE**, the formula of the anhydrous salt from the container.
3) Record on your **DATA TABLE**, the formula weight (molar mass) of the anhydrous salt to **four** significant figures.
4) Record on your **DATA TABLE**, the formula weight (molar mass) of water to **three** significant figures.

- **DAY 1:**

1) Obtain a clean, dry crucible with cover. Find their mass to the nearest **0.01g**. Record the mass on the **DATA TABLE**.
2) Obtain your assigned sample of the hydrate crystals and place them into the crucible. The crucible should be between one-fourth and one-third full. Replace the cover and find the mass. Record the mass on the **DATA TABLE**.
3) Place the partially covered crucible on the triangle and heat gently, with a non-luminous flame, until most of the water has been driven off. Then increase the heat until the crucible bottom is at most a dull red. Maintain this temperature for five minutes.
4) When the covered crucible is cool enough to touch, transfer it to the balance and find the mass. Record the mass on the **DATA TABLE**.

Formula of the anhydrous salt.	
Molar Mass of the anhydrous salt.	
Molar Mass of water.	
Mass of the crucible and cover.	
Mass of crucible, cover, and sample before heating (hydrate).	
Mass of crucible, cover, and sample after heating (anhydrous salt).	

CALCULATIONS:

1. Calculate the number of grams of the **anhydrous** salt you prepared. Show work below.

2. From the number of grams of the anhydrous salt in step 1 of calculations, calculate the number of moles of the anhydrous salt you prepared. Show work below.

3. How many grams of water were in your hydrate sample? How many moles of water were obtained.

4. What is the empirical formula of the hydrate? Show work on how it was obtained. (REMEMBER, we cannot use part of a water molecule, so round your answer to the nearest whole number)