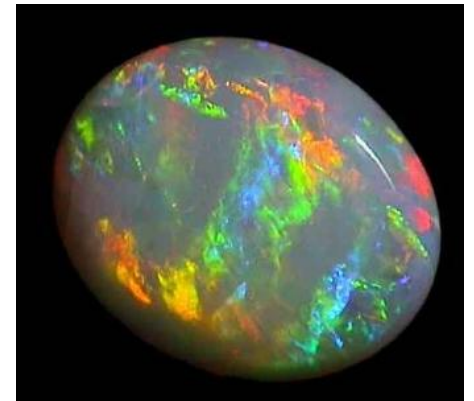


Hydrate Lab

Hydrates

- A hydrate is a compound that incorporates a certain number of water molecules into its crystal lattice.
- The formula of an opal is $\text{SiO}_2 \cdot n\text{H}_2\text{O}$ where n indicates the number of water molecules and ranges from 1-4 in nature.



Hydrates

- A monohydrate is 1 water molecule.
 - A dihydrate is 2 water molecules.
 - A pentahydrate is 5 water molecules.
 - A decahydrate is 10 water molecules.
- All the prefixes for molecular naming are the same for hydrates!

Determining the Formula of a Hydrate

- **Statement of problem:** Given 2-3 g of a hydrated complex, heat to constant mass, and use molar ratios to calculate the number of water molecules in the chemical formula.

Hydrate Lab

- **Background information:**
- What is a hydrate?
- What is the formula for your anhydrous compound (without the water molecules)?
- How do you find the molar mass? What is the molar mass of the anhydrous formula?
- Continued... →

Sample Calculation

- *Data:* An empty crucible has a mass of **12.770 grams**. The crucible and hydrate have a mass of **13.454 grams**. After heating, the crucible and anhydrous salt have a mass of **13.010 grams**. What is the formula of $\text{MgSO}_4 \cdot n\text{H}_2\text{O}$?

- *1. Use the measured masses to find:*

Mass of hydrate = $13.454 - 12.770 = 0.684$ grams

Mass of anhydrous salt = $13.010 - 12.770 = 0.240$ grams

Mass of water = $0.684 - 0.240 = 0.444$ grams

- *2. Find the moles of each:*

Moles of anhydrous salt = $0.240 \text{ grams MgSO}_4 \times \frac{1 \text{ mol MgSO}_4}{120.36 \text{ g MgSO}_4} = 0.00199 \text{ mol MgSO}_4$

Mol of water = $0.444 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18.015 \text{ g H}_2\text{O}} = 0.0246 \text{ mol H}_2\text{O}$

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Sample Calculation

- *Use the mole ratio of anhydrous/water*
- Ratio of moles of water to moles of anhydrous salt = $.0246 / .00199 = 12.36$
- Since you can't have ".36" of a mole of water...you have 12 moles of water molecules for every 1 mole of MgSO_4
- The formula is **$\text{MgSO}_4 \cdot 12\text{H}_2\text{O}$**

Solve this hydrate problem:

- Find the formula of the hydrate $\text{BeO} \cdot n\text{H}_2\text{O}$ with the data collected below
- Mass of hydrate = 8.61 grams
- Mass of anhydrous BeO = 5.01 grams
- Mass of water = ? Grams
- What is the mass of the water?
- What is the molar mass of BeO ?
- What is the formula of the hydrate?

Here's what you do!

- You will heat 2-3 g of the solid in an evaporating dish to a constant mass. Record all of your masses in a data table and do your calculations.
- I will give you the accurate # of hydrates and you must come within 10% of the accepted value to finish!