Hydrate Lab

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Purpose: The purpose of this lab is to determine the correct magnesium sulfate hydrate (calculate the correct number of water molecules) tested in this experiment.

Materials: Bunsen burner, ring stand, clay triangle, crucible, crucible tongs, goggles, magnesium sulfate hydrate

Procedure:
1. Put on safety goggles and lab aprons. Keep them on for the entire lab.
2. Obtain a clean and dry crucible. Measure and record its mass.
3. Fill approximately ⅓ of the crucible with the magnesium sulfate hydrate. Measure and record the total mass.
4. Set the ring on the ring stand just higher than the Bunsen burner. Put the crucible on it.
5. Light the Bunsen burner with a medium blue flame, and place under the crucible. Heat the crucible for approximately 10 minutes, or until the magnesium sulfate hydrate is reduced to a powdery white substance.
6. Turn off the Bunsen burner. Allow the crucible to cool.
7. Measure and record the total mass of the crucible and its contents (anhydrous magnesium sulfate).
8. Rinse the magnesium sulfate down the sink, and clean and dry the crucible.

Data Table:

Subject	Mass (g)
crucible	8.88
crucible with magnesium sulfate hydrate	12.10
magnesium sulfate hydrate (*calculated*)	3.22
crucible with anhydrous magnesium sulfate	10.54
anhydrous magnesium sulfate (*calculated*)	1.66
water (*calculated*)	1.56

Calculations:

a.   *mass $MgSO_4$ hydrate* $= 12.10g - 8.88g = 3.22g$

   mass $MgSO_4$ $= 10.54g - 8.88g = 1.66g$

   mass H_2O $= 3.22g - 1.66g = 1.56g$

   $\% \ H_2O = \frac{1.56g}{3.22g} \times 100\% = 48.4\%$

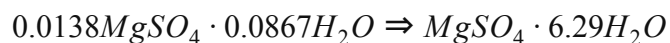   <u>The percent mass of water is **48.4%**.</u>

b.   *molar mass $MgSO_4$* $= 24.3g \ (Mg) + 32.1g \ (S) + 4 \times 16.0g \ (O) = 120.4g/mol$

   molar mass H_2O $= 2 \times 1.0g \ (H) + 16.0g \ (O) = 18.0g/mol$

   $1.66g \times \frac{mol \ MgSO_4}{120.4g} = 0.138mol \ MgSO_4$

   $1.56g \times \frac{mol \ H_2O}{18.0g} = 0.0867mol \ H_2O$

   $0.0138MgSO_4 \cdot 0.0867H_2O \Rightarrow MgSO_4 \cdot 6.29H_2O$

   <u>The magnesium sulfate hydrate is **$MgSO_4 \cdot 6H_2O$ (magnesium sulfate hexahydrate**).</u>

c. $\% \ error = \frac{|48.4\% - 51.2\%|}{51.2\%} \times 100\% = 5.47\%$

   <u>There is a **5.47% error** for the percentage of water.</u>