Name:

Determining the formula of a hydrate.

Background: In a hydrate, the ratio of moles of water to moles of compound is a small whole number. This ratio can be determined by heating the hydrate to remove water.

Essential Question: How can you determine the moles of water in a mole of hydrated compound?

Materials:
- Bunsen burner
- Ring stand and ring
- Crucible
- Clay triangle
- Crucible tongs
- Balance
- Epson salts (MgSO₄ hydrated)
- Spatula
- Grill lighter

Procedure:
1. Measure the mass of the crucible in grams. Record in data table 1.
2. Add a small sample of hydrated MgSO₄ to the crucible. Measure the mass of the crucible and hydrated MgSO₄ in grams. Record in data table 1.
3. Observe the physical properties of the hydrated MgSO₄ and record this in data table 1. (properties that can be directly observed)
4. Place the clay triangle on the ring stand. Adjust the ring so the triangle will be positioned near the tip of the Bunsen burner flame.
5. Carefully place the crucible in the triangle.
6. Light the Bunsen burner. Heat the crucible for about 10 minutes. Turn off burner.
7. Allow the crucible to cool for at least 5 minutes.
8. Remove the crucible using the crucible tongs and mass of the crucible with the anhydrous MgSO₄. Record the mass after heating on data table 1.
9. Observe the physical properties of the anhydrous MgSO₄ and record this in data table 1.
10. Clean up lab station and prepare to calculate the analysis.
Data Table 1

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mass of crucible (g)</td>
</tr>
<tr>
<td>2.</td>
<td>Mass of crucible and hydrated MgSO₄ (g)</td>
</tr>
<tr>
<td>3.</td>
<td>Mass of hydrated MgSO₄ (#2 - #1) (g)</td>
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<tr>
<td>4.</td>
<td>Molar Mass of MgSO₄ (show work)</td>
</tr>
<tr>
<td>5.</td>
<td>Molar Mass of water (H₂O) (show work)</td>
</tr>
<tr>
<td>6.</td>
<td>Physical properties of hydrated MgSO₄</td>
</tr>
<tr>
<td>7.</td>
<td>Mass of Crucible and anhydrous MgSO₄ (mass after heating) (g)</td>
</tr>
<tr>
<td>8.</td>
<td>Mass of anhydrous MgSO₄ (#7 - #1) (g)</td>
</tr>
<tr>
<td>9.</td>
<td>Difference between mass of hydrated MgSO₄ and anhydrous MgSO₄ (This is the mass of H₂O lost as a result of heating) (#3 - #8)</td>
</tr>
<tr>
<td>10.</td>
<td>Physical properties of anhydrous MgSO₄</td>
</tr>
<tr>
<td>11.</td>
<td>Formula for hydrate</td>
</tr>
</tbody>
</table>

Analysis:

**Calculate the formula of the hydrate of MgSO₄. Show all work.**

**Step 1:** Find the difference between the mass of the hydrated MgSO₄ and the anhydrous MgSO₄ (record in data table)

**Step 2:** Convert the mass of anhydrous MgSO₄ and H₂O lost as a result of heating to moles by dividing by their molar masses.

**Step 3:** Divide the moles of H₂O by Moles of MgSO₄ and round to a simple whole number.

**Step 4:** Substitute the whole number calculated in step 3 for x in the following formula: MgSO₄ · x H₂O. The x represents the ratio of water molecules per formula units of MgSO₄ (record in data table)

- Define Hydrate:

- Define Anhydrous: