Lab Report: Gravimetric Analysis of an Unknown Sulfate

Experimental Data

Unknown Sulfate ID Code: __________

<table>
<thead>
<tr>
<th></th>
<th>Mass of Empty Beaker</th>
<th>Mass of 250-mL beaker and unknown sulfate</th>
<th>Mass of unknown sulfate</th>
<th>Mass of empty crucible (without lid)</th>
<th>Mass of crucible (without lid) and barium sulfate</th>
<th>Mass of barium sulfate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Calculations and Conclusions

1. Calculate the mass of sulfate in the unknown sample. Clearly show each step of your calculation.

2. Calculate the percentage by mass of sulfate in the unknown sample. Show your work.

3. Calculate the percentage by mass of the metal in the unknown sample. Show your work.
4. The cation in your unknown metal sulfate is one of the following:

\[
\text{Al}^{3+} \quad \text{Na}^+ \quad \text{Ni}^{2+} \quad \text{K}^+ \quad \text{NH}_4^+ \quad \text{Cd}^{2+}
\]

Use this information along with your experimental results to determine which cation it is.

Unknown Sulfate ID Code: __________ Identity of Cation: __________

Show all of your work with clear, logical steps below. Clearly explain how your calculations here along with your experimental results for #2 and/or #3 allowed you to identify the cation in the metal sulfate.
Questions

1. Suppose an unknown metal sulfate is found to be 72.07 % \( \text{SO}_4^{2-} \). Assuming the charge on the metal cation is +3, determine the identity of the cation.

2. The unknown metal sulfates are hygroscopic and will absorb water from air. The unknowns must thus be kept in desiccators to remove any absorbed water. How would your results be affected if your unknown sample was not desiccated? Would this error cause your calculation of the mass percent of sulfate in the unknown to be too high or too low? Explain.
3. In this experiment you used an excess of the BaCl\textsubscript{2} solution. How would your results be affected if you did not use an excess of the BaCl\textsubscript{2} solution? Would this error cause your calculation of the mass percent of sulfate in the unknown to be too high or too low? Explain.

4. In the last step of the procedure, you vigorously heated the BaSO\textsubscript{4} precipitate wrapped in filter paper in a crucible. How would your results be affected if tiny pieces of the filter paper still remained mixed in with the BaSO\textsubscript{4} after heating? Would this error cause your calculation of the mass percent of sulfate in the unknown to be too high or too low? Explain.