The Case of the Contaminated Well

Scenario
Local commissioners decided it was time for the county to have its own Crime Investigative Service. Since you are a highly decorated chemistry student in high school, you have been hired to start this new crime fighting division. On your first day on the job, you get a call from an elderly woman with a complaint against the “lousy, good-for-nothin’ teenagers who lived next door.” She reports that these kids contaminated her well with some type of liquid. “I saw them do it! They put something in there and now I am afraid to drink my water!” You decide to take a sample of her well water for analysis. While interviewing the accused, you notice an unmarked container of water sitting on the workbench of the garage. Possibly, this contained the liquid that was added to the well. To be sure, you collect a sample to compare to the well sample. Fortunately, you remember a procedure that you conducted in chemistry class, called a flame test. It is a way to identify certain metal ions in a solution. You create a series of known solutions with possible contaminants and test them against both the garage sample and the neighbor’s well.

Materials
- Metallic Salt Solutions in labelled 100mL beakers:
  - 1.0M Barium Chloride (BaCl₂)
  - 1.0M Calcium Chloride (CaCl₂)
  - 1.0M Copper Chloride (CuCl₂)
  - 1.0M Lithium Chloride (LiCl)
  - 1.0M Potassium Chloride (KCl)
  - 1.0M Sodium Chloride (NaCl)
  - 1.0M Strontium Chloride (SrCl₂)
- Evidence Sample from Well
- Evidence Sample from Garage
- 250mL beakers of water (for extinguishing flame)
- Bunsen burners
- Wooden splints

Safety
- Barium chloride is highly toxic. Do not ingest the salt or solution.
- Always wear safety goggles when handling chemicals in the lab.
- Wash your hands thoroughly before leaving the lab.
- Follow the teacher’s instructions for cleanup of materials and disposal of chemicals.
- Always use caution around open flames. Keep flames away from flammable substances.
- Always be aware of an open flame. Open flames can cause burns. Do not reach over it, tie back hair, and secure loose clothing.

Procedure
1. You will spend 4-5 minutes at each lab station.
2. At each station you will find a labelled beaker containing a metal salt solution. There will be several wooden splints soaking in the solution.
3. Place a wooden splint soaked with the solution into a flame and observe the color. Record your observations in the data table provided.
4. When finished, extinguish the splint in the provided beaker of water. **Note:** after the water solution has vaporized from the splint, the wooden splint gives off a yellow/orange flame. This is not to be confused with the actual color of the solution.

5. Move through all of the stations and repeat steps 3 and 4 with each known sample.

6. After you have collected data from each station, repeat steps 3 and 4 for both the evidence sample from the well and the evidence sample from the garage. Record your observations in the data table provided.

**Data**

<table>
<thead>
<tr>
<th>Known Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Station</strong></td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
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<tr>
<td>5</td>
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<tr>
<td>6</td>
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<tr>
<td>7</td>
</tr>
</tbody>
</table>

**Forensic Evidence Samples**

<table>
<thead>
<tr>
<th>Evidence type</th>
<th>Color Observed</th>
<th>Possible Contaminant Identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well Sample</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Garage Sample</td>
<td></td>
<td></td>
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</tbody>
</table>

**Forensic Analysis**
The leading detective of the case is wondering if he should press charges against the neighboring teenager. Write a report explaining your test and how he should proceed with the case.