

Name \_\_\_\_\_\_\_\_\_\_\_\_\_

Date \_\_\_\_\_\_\_\_\_\_\_\_\_

Period \_\_\_\_\_



What do the **STREET LAMP, SALT**, and **FIREWORKS** have in common?

They all contain **SODIUM** which gives off a unique orange flame when heated

**PURPOSE:**

1) To observe the effect of **excited** electrons in several metallic elements by exposing the metals ions to a flame.

2) To use the above effect as a technique for identifying **unknown** metals.

**BACKGROUND KNOWLEDGE:**

1. Who made the important discovery that energy levels of electrons are quantized (only existing in certain, specific levels)?

2. What happens to an electron when energy is added?

3. What is released when an electron loses energy?

4. What determines the frequency (color) of photons?

5. Why do you think the frequencies (color) for a specific element is always the same?



**MATERIALS:**

* Salts containing the following metal ions:

Barium ion: Ba+2 Calcium ion: Ca+2

Copper II ion: Cu+2 Lithium ion: Li+

Potassium ion: K+ Sodium ion: Na+

Strontium ion: Sr+2 Unknown ion (UNK #1, #2)

* Bunsen burner
* Wire loop
* HCl
* Well plate
* 50 mL beaker

**SAFETY:** Goggles and aprons must be worn at all times!

**PROTOCOL:**

1. Collect a couple of drops of each solution in each of the wells of the well plate. Be sure to note the ORDER of the solutions on the back of this sheet.

2. Record the name of the compound in your *flame test data table*. (Two of the lab stations contain *unknowns*, be sure to record the unknown #1 and #2! You’ll determine the unknown compound after you’ve collected all of your data.)

3. Determine the key metal to be observed and record the name of the metal in the *flame test data table*.

4. You must clean the wire loop before each flame test. **Cleaning** is done by dipping the loop of wire into the HCl provided in the beaker, and putting the loop into the middle of the flame on the Bunsen burner for one minute. **Do this twice, until the all color is gone, and flame is "clear" after about 30 seconds.**

5. Hold the wire loop in the flame and record your observations in the *flame test data table* under flame color. Be sure to record the initial color that you see in the flame.

*Remember the metal ions are paired with a nonmetal ion in an ionic formula unit. The electrical charges have to add to zero. The metal ions are converted to atoms in the flame and then excited by the heat from the Bunsen burner flame. The nonmetal ions, anions*, do *not get converted to atoms and do not and emit visible light like the metals do.*

6. Clean up. Rinse the well plate, clean the flame test wire as described in procedure three, and tidy the bench top.

**OBSERVATIONS**

**IMPORTANT:** When observing the colors resulting from the flame testing of the above metals, you will notice that several of them have *very similar hues.*  You MUST record enough information about the color to be able to distinguish between them, because you will have to identify your unknown based on the colors you record. You may have to flame-test the similarly colored ions more than once to get a really good description of the flame-test color. PLEASE BE THOROUGH in your color descriptions (use more than one or two words and use comparisons)!

**DATA:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample** | **Sample**  **Name** | **Metal**  **Ion** | **Flame Color** |
| 1 | **NaNO3** |  |  |
| 2 | **KNO3** |  |  |
| 3 | **LiNO3** |  |  |
| 4 | **SrCl2** |  |  |
| 5 | **Ca(NO3)2** |  |  |
| 6 | **Ba(NO3)2** |  |  |
| 7 | **CuCl2** |  |  |
| 8 | **Sr(NO3)2** |  |  |
| 9 | **Cu(NO3)2** |  |  |
| 10 | **NaCl** |  |  |
| 11 | **UNK # 1** |  |  |
| 12 | **UNK # 2** |  |  |

**DATA PROCESSING:** There are no calculations for this lab. Please omit this section from your report.

**CONCLUSION/ANALYSIS:**

Write at least one paragraph that explains the science behind your experimental results. Describe how this is related to what we are currently learning in class and include an error analysis.

**DISCUSSION QUESTIONS:**

1. Identify which metal ion is Unknown #1 and #2, and give evidence from the data to support your choice. Please mention the UNKNOWN #!

2. Why do the chemicals have to be heated in the flame first before the colored light is emitted?

3. Explain WHAT is producing the emitted light, and WHY the different metal ions produce these different colors. Keep this explanation fairly brief.

4. E.T. comes to visit you and brings along some alien crystals.  How could you identify the elements in these crystals?

5. When a pan of milk boils over onto the stove the flame turns red-orange.  Explain why.

6. A firework contains copper chloride and strontium sulfate.  What colors will this explosive produce?