Chemistry Lab #5: The Flame Test

**Introduction**

Each element’s atomic emission spectrum is unique and can be used to determine if that element is part of an unknown compound. This is because when certain compounds are heated in a flame, they emit a distinctive color because of the movement of electrons from their ground state.

The flame test is a qualitative test used in chemistry to help determine the identity or possible identity of a metal or metalloid ion found in an ionic compound. If the compound is placed in the flame of a gas burner, there may be a characteristic color given off that is visible to the naked eye. This is because every atom consists of a nucleus with tiny electrons whizzing around it. The further away from the nucleus they are, the more energy the electrons have. If a metal ion is heated, the electrons get enough energy to jump higher away from the nucleus. When they fall back closer to the nucleus, they give off this extra energy as light called a photon.

We will investigate the atomic emissions of 6 salt solutions and 2 unknowns.

* Sodium Chloride
* Copper Chloride
* Strontium Chloride
* Lithium Chloride
* Potassium Chloride
* Barium Chloride

Look at the periodic table and your electromagnetic spectrum to make your hypothesis answering the question about what elements will be what color depending on their electrons distance from the nucleus and the amount of energy each visible color has on the electromagnetic spectrum. To help you investigate the background information needed to answer this question answer the following pre-lab questions (Write the answer on the leftside of your lab book across from the purpose, materials, and procedure)

1. Write the **electron configuration** of each of the metals in the salt solutions to determine the distance the outer electrons are from the nucleus.
2. Write the visible light colors in order of relative increasing frequency.
3. Make a table with the above information you gathered to **predict the color** produced by each heated metal salt solution.

**Materials**

-Bunsen burner; Q tips; given chemicals above.

**Procedure**

1. To do the flame test, dip the Q tip into one of the test compounds (I prefer if you leave sodium chloride for last). Hold the Q tip in the hottest part of the Bunsen burner flame (which is at the bottom of the flame). Make note of the color change of the flame on your flame test data table.
2. Get a new Q tip and repeat step 1.
3. Test another compound and record result. Continue until you have seen a color for all of the test compounds.
4. Now test your 2 unknown solutions in the same manner.
5. Identify your unknown by their atomic emission spectra.

**Data Table/Observations**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Solution** | **Color** | **Wavelength (nm)** | **Wavelength(m)** | **Frequency (Hz)** |
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|  |  |  |  |  |
| **Unknown 1** |  |  |  |  |
| **Unknown 2** |  |  |  |  |

**Post Lab (answer each of the following in your lab book…before your conclusion)**

1. Check with your instructor to see if your conclusions about the unknowns were correct. If they were correct how did you know this information, if they were incorrect, why? (Color and Calculation)
2. Were your predictions correct in your hypothesis? Why do you think you were right or why were you incorrect? Does it correlate with the periodic table?
3. Explain the correlation you can see between the electrons ground state and frequency of colors on the Electromagnetic Spectrum.
4. Could an electron in a high ground state, still produce a low amount of energy? Did you see an example of this in the lab?