**Flame Test for Metals**

**Background**

Have you ever wondered why a candle flame is yellow? The characteristics yellow of a candle flame comes from the glow of burning carbon fragments. The carbon fragments are produced by the incomplete combustion reaction of the wick and candle wax. When elements, such as carbon, are heated to high temperatures, some of their electrons are excited to higher energy levels. When these excited electrons fall back to lower energy levels, they release excess energy in packages of light called ***photons***, or light quanta. The color of the light emitted depends on its energy. Blue light is more energetic than red light, for example. When heated, each element emits a characteristic pattern of light energies, which is useful for identifying the element. The characteristic colors of light produced when substances are heated in the flame of a gas burner are the basis of flame tests for several elements. In this experiment, you will perform the flame tests used to identify several metallic elements.

**Materials**

* safety goggles
* Q-Tips
* 1 gas burner
* 1 50 ml beaker
* potassium chloride (KCl)
* calcium chloride (CaCl2)
* strontium chloride (SrCl2)
* lithium chloride (LiCl)
* copper (II)chloride (CuCl2)
* sodium chloride (NaCl)
* barium chloride (BaCl2)
* magnesium strip
* tongs
* 2 unknown samples
* paper towels

**Procedure**

***Do no copy down each step. Just summarize and refer to this lab handout in your lab report.***

1. At your station, determine what metal salt (or unknown) you are testing.
2. Dip the clean Q-Tip into the sample of metal salt solution and heat the sample in the burner flame. Record the color of the flame in the data table.
   * For the sample of magnesium, hold a piece of magnesium with tongs in the flame approximately 10-15 seconds. Once the reaction begins, take the piece of magnesium out of the flame. Look at the sample for a second or two and then turn your head away and use only your peripheral vision to observe.
   * Do NOT catch dry Q-Tips on fire. Once the color is observed, please place the used Q-Tip in the DISCARD beaker.
3. Record your observations. Record the color and how quickly the sample burned and if there was any change in color. Be very descriptive in your observations so you have good data to compare to your unknowns.
4. Record the wavelength of the color your observed using the given spectrum at your station.
5. Make sure your lab station area is clean and in order.
6. Move to the next station as space becomes available.
7. Repeat steps 3-6 at each station. Be sure to clean up after yourself each time.
8. Perform a flame test on the unknown salts. Record your observations.
   * The solutions are in the labeled spray bottles.
   * Spray the solution into the flame. Make sure that you are holding the spray bottle approximately 2 feet away from the flame.
   * When finished, repeat the process with the second solution.
   * Compare your results to the metal salts you already tested to decide which ones are in the spray bottles.

**Data Table:**

**NEAT AND ORGANIZED**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sample** | **Color** | **Observations** | **Wavelength** | **Frequency** |
| **Potassium** |  |  |  |  |
| **Calcium** |  |  |  |  |
| **Strontium** |  |  |  |  |
| **Lithium** |  |  |  |  |
| **Copper** |  |  |  |  |
| **Barium** |  |  |  |  |
| **Sodium** |  |  |  |  |
| **Magnesium** |  |  |  |  |
| **Unknown**  **#1** |  |  |  |  |
| **Unknown**  **#2** |  |  |  |  |

**Calculations**

Show all your calculations used to determine the frequency of each sample. Use you notes to know how to complete the calculations.

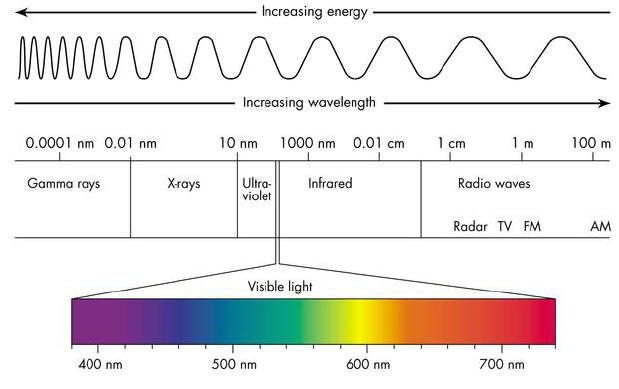
**Questions**

Must be answered in complete sentences.

1. What elements produced the most easily identified colors?
2. What elements were not easily identified?
3. List the elements in order of increasing frequency, does this correlate with the visible light spectrum?
4. Draw a Bohr Model for each of the known elements. (2 points)

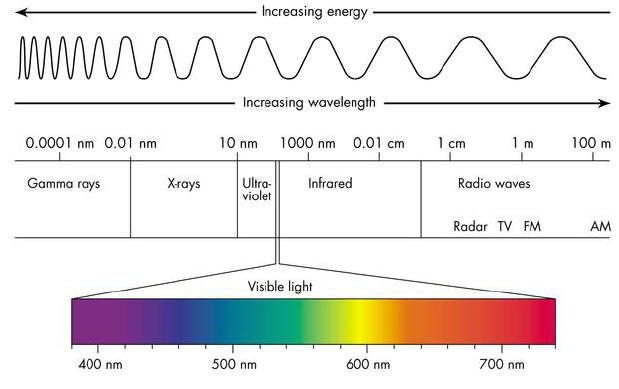
BE SURE TO COMPLETE ALL PARTS OF YOUR FORMAL LAB WIRTE UP!

Use the spectrum to determine the wavelength of the light in the sample you just observed. Get as close as you can and as accurately as you can (remember those UNCERTAINTY values). Choose the color that BEST fits… there are some that may have a mix of more than one color, but for our purposes, just choose the most dominant color.



These values are in nanometers (nm), or 1 x 10-9 m. Convert to meters and record the wavelength in METERS (m) in your data table.

Use the spectrum to determine the wavelength of the light in the sample you just observed. Get as close as you can and as accurately as you can (remember those UNCERTAINTY values). Choose the color that BEST fits… there are some that may have a mix of more than one color, but for our purposes, just choose the most dominant color.



These values are in nanometers (nm), or 1 x 10-9 m. Convert to meters and record the wavelength in METERS (m) in your data table.