

# FLAME TEST LAB

## Honors Chemistry

Name \_\_\_\_\_ Pd \_\_\_\_\_

### Learning Objective:

In this lab, you will compare the **atomic spectrum** of known chemicals with an unknown to determine the cation (metal) present in that chemical. You must first perform a **flame test** of the known chemicals. Then, you will perform a **flame test** with an unknown solution to see if it matches the cation in any of the solutions you've used.

### Background:

When **electrons** absorb energy, they jump up an **energy level**. However, what goes up must come down! They fall back down from this **excited state** and give off energy in the form of light. Since each element has a unique structure and arrangement of electrons, each atom emits a unique **wavelength** of light therefore, each element gives off it's own unique color. This is how the chemical test known as a **flame test** works. The atoms are excited by being placed within a flame. As they re-emit the energy in the form of light, the color of the flame changes. Be sure to keep the equipment very clean, and perform multiple trials to check your work as contamination can change your results!!!

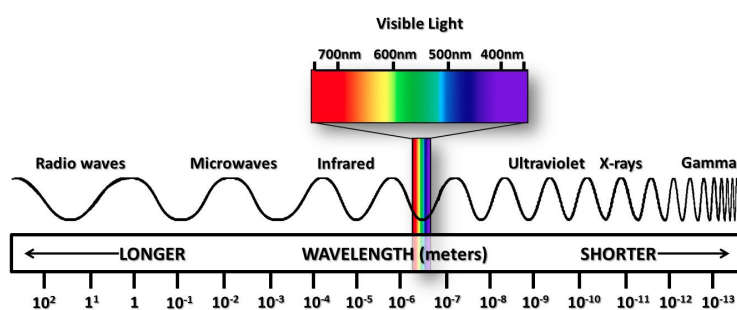
### Materials

- Bunsen burner
- Small beaker of chemical
- Metal loop
- 9 chemicals
  0. Barium chloride (Demo)
  1. Magnesium chloride
  2. Strontium chloride
  3. Copper (II) sulfate
  4. Calcium chloride
  5. Potassium chloride
  6. Lithium chloride
  7. Sodium chloride
  8. Unknown substance



### Procedures

1. You will move from station to station to test your samples!
2. When you arrive at a station, light the Bunsen burner.
3. Then, dip a wooden splint in the solution and move it slowly into the flame, gently waving back and forth.
4. Observe the flame color. As soon as the wood ignites, remove it from the flame and dip it into the beaker of water.
5. Record your observations in the Data Table.
6. Place used wood splints in the location provided.
7. Repeat steps 2-6 for all the chemicals listed above, including the **unknown** substance. **BE EXTRA CAREFUL NOT TO DRIP OR CROSS CONTAMINATE!** When instructed, move to the next station.
9. After your last station, wash your hands, return to your seat, and analyze! ©



## Data Table

Lab	Chemical Solution	Cation (Metal)	Flame Color	Wavelength (in nm)	Frequency (in Hz)	Energy of the Photon (J)
Dem o	Barium chloride	Ba <sup>2+</sup>				
1	Magnesium chloride	Mg <sup>2+</sup>				
2	Strontium chloride	Sr <sup>2+</sup>				
3	Copper (II) sulfate	Cu <sup>2+</sup>				
4	Calcium chloride	Ca <sup>2+</sup>				
5	Potassium chloride	K <sup>+</sup>				
6	Lithium chloride	Li <sup>+</sup>				
7	Sodium chloride	Na <sup>+</sup>				
8	Unknown	#####				

### Analysis Questions

- Given the chart of approximate wavelengths for different colors of visible light, calculate the wavelength, frequency, and energy of each photon for all of the metals. Show all work on a separate sheet of paper and attach to your lab. Round your answers to three significant figures.

Color	Wavelength (nanometers)
Red Light	~650 nm
Orange Light	~590 nm
Yellow Light	~570 nm
Green Light	~510 nm
Blue Light	~475 nm
Indigo Light	~445 nm
Violet Light	~400 nm

- What is the identity of the **cation** in the **unknown** solution? **Explain** how you came to that decision.
- The energy of colored light increases in the order red, yellow, green, blue, violet. List the metallic elements used in the flame test in **increasing** order of the light emitted.
- Draw a diagram showing how the atoms of the substances in our lab reacted to the flame. Be sure to label and identify what's happening when the electrons are in their **ground and excited states**.