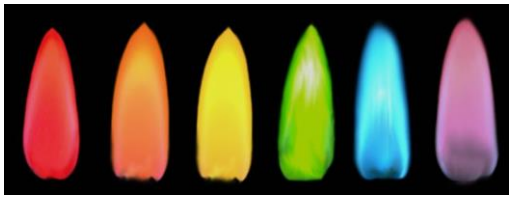
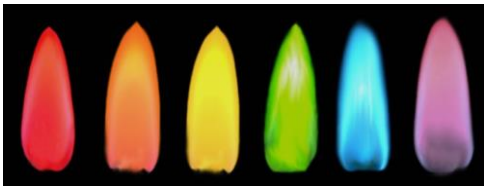


Flame Lab



Introduction: The color of light emitted by an element heated in a flame is unique to each element. In this experiment, the characteristic color of light emitted by calcium, copper, lithium, potassium, sodium, and strontium ions will be observed.

Background: The color of the flame may be described in terms of its wavelength, and Equation 1 and Equation 2 may be used to calculate the energy of the emitted photon.

$$E = h\nu \quad \text{Equation 1} \qquad c = \lambda\nu \quad \text{Equation 2}$$

E → difference in energy between the two energy levels in joules (J)
h → Plank's constant ($h = 6.626 * 10^{-34}$ J*s)
c → speed of light ($c = 3.0 * 10^{8}$ m/s)
λ → (lambda) wavelength of light in meters
ν → (nu) frequency of a wave in seconds

Table 1: Wavelengths of visible light

Representative Wavelength, nm	Wavelength Region, nm	Color
410	400-425	Violet
470	425-480	Blue
490	480-500	Blue-green
520	500-560	Green
565	560-580	Yellow-green
580	580-585	Yellow
600	585-650	Orange
650	650-700	Red

Procedure:

1. Light your Bunsen burner using the striker. Adjust the flame to the correct size.
2. Place the nichrome wire in the flame. Hold the nichrome wire in the flame until the flame is a consistent orange color.
3. Place the nichrome wire in the test solution and then back into the flame.
4. Record the first color that you see in your data table for the solution you tested.
5. Place the nichrome wire on the lab counter.
6. Write a description of the color in Table 2 and make the color using the colored pencils.
7. Turn off the Bunsen burner before going to the next station.
8. Repeat steps 2-6 for all eight stations.

Table 2: Data Table

Symbol	Element Name	Color (words)	Color (picture)	Wavelength (λ)
Ca				
Cu				
K				
Li				
Na				
Sr				
Unknown 1				
Unknown 2				

For the unknown solutions, write the name of the element(s) that you believe appear in that beaker. Use the information from the other stations to help determine this.

Calculations

Ca:

Wavelength _____ Frequency _____ Energy _____

Cu:

Wavelength _____ Frequency _____ Energy _____

K:

Wavelength _____ Frequency _____ Energy _____

Li:

Wavelength _____ Frequency _____ Energy _____

Na:

Wavelength _____ Frequency _____ Energy _____

Sr:

Wavelength _____ Frequency _____ Energy _____

Unknown 1:

Wavelength _____ Frequency _____ Energy _____

Unknown 2:

Wavelength _____ Frequency _____ Energy _____

Wavelength _____ Frequency _____ Energy _____

Conclusions

What element(s) were in Unknown 1 and 2? How do you know? Explain.

Discussion of Theory

In detail, explain the concepts and ideas of the lab experiment. Think about answering what, why, and how for each idea/concept. To further help you, consider the following questions: How were the colors of the flames produced? What is happening at the atomic level to cause the different colors? Why is this unique for each element? What properties do each of these colors have? What relationship do these properties have to each other?

Post Lab Questions

1. Put the six substances in order from highest wavelength to lowest wavelength.

   Highest: _____, _____, _____, _____,

   _____, _____, Lowest

2. The alkali metals Cesium and Rubidium were discovered based on their characteristic flame colors. Cesium is named after the sky and rubidium after the gem color. What colors of light do you think these metals give off when heated in a flame?

   Cesium _____ Rubidium _____

3. How do you think metallic salts are used in fireworks? List some examples.

4. What is one source of error that could cause the wrong colored flame to be produced? Explain.