

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.

$$E = h \nu$$
 Equation 1

$$c = \lambda v$$

Equation 2

- E → difference in energy between the two energy levels in joules (J)
- h \rightarrow Plank's constant (h = 6.626 * 10-34 J*s)
- c \rightarrow speed of light (c = 3.0 * 108 m/s)
- $\lambda \rightarrow$ (lambda) wavelength of light in meters
- $\nu \rightarrow$ (nu) frequency of a wave in seconds

Table 1: Wavelengths of visible light

Representative	Wavelength Region, nm	Color
Wavelength, nm		
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 soaked wooden splint in the flame. Hold the splint in the flame for about 10 seconds. **If it starts smoking put it in the waste beaker immediately**
- 3. While the splint is burning observe the color.
- 4. Place the burnt splint in the waste beaker.
- 5. Write a description of the color in Table 2 and make the color using the colored pencils at your station.
- 6. Never leave a flame unattended. Choose one person to be the "keeper of the flame" until the next group arrives.
- 7. Repeat steps 2-6 for all eight stations.

Table 2: Data Table (60 points)

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

^{**}For the unknown flasks, write the name of the element(s) that you believe appear in that flask. Use information from the other stations to help.**

Post Lab Questions (5 points per question)

		Lowest
	Highest:,,,,,	
1.	. Put the eight substances in order from highest wavelength to lowes	t wavelength.

2. Why do different elements have unique flame test colors?

3.	What element(s) were in Unknown 1? Why did you pick that element(s)?
4.	What element(s) were in Unknown 2? Why did you pick that element(s)?
5.	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
6.	How do you think metallic salts are used in fireworks? List some examples.
7.	Why do the chemicals have to be heated in the flame before the colored light is emitted?
8.	Could flame tests be useful in determining identities of metals in a mixture of two or more salts? If so, what problems might arise? If not, why not, explain your answer.