Flame Test Worksheet

By placing atoms of a metal into a heat source, electrons can be induced to absorb energy and jump to excited energy states. Then, by emitting photos of light, they return to their ground states. The amount of energy in the photon determines its color; red for the lowest energy visible light, increasing energy through the rainbow of orange, yellow, green, blue, indigo and violet for the highest energy visible light. Photons outside the visible spectrum may also be emitted, but we cannot see them. Remember that ultraviolet follows violet as the spectrum increases in energy. Chemical engineers use this low-tech and very reliable flame test to identify an element based on the color it emits when placed in a flame.

The arrangement of electrons in an atom determines the sizes of the quantum jumps, and thus the energy and colors of photons emitted.

In this lab we will prepare .2 M solutions of strontium chloride, copper II chloride, and potassium chloride. We will test the solutions to identify the distinct color each metal ion produces when placed in a Bunsen burner flame. Then we will calculate the approximate frequency and energy of each wavelength of visible light. With what we learn from this collected data, we will identify the metal in a solution of unknown identity. Have fun!

Pre-Lab Questions
1. List the electromagnetic spectrum from lowest to highest energy.

2. Of visible light, what color is lowest in energy? What is highest?

3. List all the cations and anions with charges present in this lab.

4. Perform the appropriate calculations for preparation of the three solutions.

    100 ml .2 M strontium chloride
    100 ml .2 M copper II chloride
    100 ml .2 M potassium chloride

Name: _____ Date: _____ Class: _____

Materials

calculator	6 wooden splints
graduated cylinder	3 plastic spoons
3 400-ml beakers	electronic balance and 3 pieces paper
100 ml .2 M strontium chloride solution	masking tape and marker
100 ml .2 M copper II chloride solution	matches
100 ml .2 M potassium chloride solution	Bunsen burner

Procedures

1. Prepare 100 ml each of .2 M strontium chloride, .2 M copper II chloride, and .2 M potassium chloride.

2. Let 2 wooden splints soak in each solution for 10 minutes.

3. Place the soaked end of the wooden splint into the hottest part of the Bunsen burner flame (the top of the inner cone).

4. Record the observed flame color.

5. Find and record the approximate visible light wavelength of each observed flame color.

6. Place a wooden splint soak with the unknown solution in the Bunsen burner flame. Record the color and identify the metal ion in the solution.

Data Collection

Solution	Observed Flame Color	Estimated Wavelength (nm)
strontium chloride		
copper II chloride		
potassium chloride		
unknown =		

Experiment Conclusions

Write a lab report with the following information included.

1. Is it the metal or the non-metal that produces the flame test color? What brought you to this conclusion?

2. The identity of the unknown metal (it is one of the metals you tested).

3. Show the calculations for the preparation of the three solutions.

4. Calculate the approximate frequency of energy given off by the emitting element in each of the three solutions.

5. How does the flame test investigation relate to the engineering design process?

Going Further

On a separate sheet of notebook paper answer the following.

The energy you observed was given off in the visible light range. Where is ultraviolet light on the electromagnetic spectrum? Does it still contain energy even thought it is not in the visible light range? Support your answer.