Name _____ Date _____ Period _____

Flame Test Chemistry

Objectives

1. Flame test solutions of several ions.
2. Provide evidence for the presence of certain atoms within compounds.

Introduction

Have you ever wondered why a candle flame is yellow? The characteristic 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 the carbon fragments, are heated to high temperatures, some of their electrons are excited to higher energy levels. These excited electrons then fall back to lower energy levels, releasing excess energy as *photons* in packages of light called *quanta*. The color of the emitted light 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.

<u>Safety Notice:</u> Roll up sleeves, tuck in loose clothing, and tie back long hair. Know the location of your beaker of water, the fire blanket, and the fire extinguisher. If the cotton swab catches fire, dunk it into the beaker of water.

Materials

Bunsen burner	disposable pipets	one penny	250 mL beaker
micro-well plate	cotton swabs (Q-tip)	copper wire	tongs

<u>Aqueous solutions of the following ions</u>

copper sulfate ($CuSO_4$)	strontium chloride ($SrCl_2$)	potassium chloride (KCl)
potassium nitrate (KNO_3)	potassium sulfate (K_2SO_4)	sodium chloride (NaCl)
copper chloride ($CuCl_2$)	sodium carbonate (Na_2CO_3)	strontium nitrate ($Sr(NO_3)_2$)

Methods

1. Fill the beaker to approximately ½ full with tap water.
2. Select one solution and add 5-10 drops into a well of the micro-well plate. Record the name of the solution in Table 1.
3. Soak one end of a unused cotton swab in the solution. On the outside edge of the burner's flame, move the solution-soaked cotton swab up and down. Observe the color of the flame and record in Table 2. If the cotton swab ignites, quickly dunk it into the beaker filled with water.
4. Repeat steps #2 and #3 until each chemical solution has been flame tested.
5. Using the tongs, hold the copper wire in the outside edge of the flame. Observe the color of the flame and record. Do not touch the hot wire!

6. Repeat step 5 with the penny. Do not touch the hot penny!
7. Clean the micro-plate by turning it over on a paper towel and tapping it to remove unused solutions prior to washing with soap and water.
8. Clean all glassware and equipment. Wash off your laboratory table. Please return materials as directed by the teacher. Wash your hands thoroughly with soap and water before leaving the lab room.

Table 1 Map of Microwell Plate

	1	2	3	4	5	6
A						
B						
C						
D						

Results

Table 2 Metal Ion and Flame Color

Name of solution	Formula	Flame color
Copper Wire		
Penny		

Questions

1. Group the nine substances based on the flame colors produced.

_____

_____

_____

_____

_____

2. What patterns do you notice in the groupings, i.e. do certain atoms produce a flame of a specific color?

_____

_____

_____

3. Predict the flame color for a substance called strontium sulfate. Explain your answer.

_____

_____

4. Based on questions 1, 2, & 3 above, write a rule stating whether the metal or the nonmetal in a compound is responsible for the color of the flame.

_____

_____

5. Can a flame test be used to identify a metal in a compound? Why or why not?

_____

_____

6. Can a flame test be used to identify a nonmetal in a compound? Why or why not?

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