Experiment #15

IDENTIFICATION OF METALLIC IONS BY FLAME TEST

PURPOSE:

To experimentally determine metals in groups IA and IIA using a flame test

INTRODUCTION

If energy is applied to an atom in the form of heat or an electrical discharge, the atom can be made to emit light. This is the process responsible for the light of neon signs and fluorescent light fixtures. If the emitted light is passed through a prism or a diffraction grating, the light can be split into its component wavelengths and is called a spectrum. When gasses are made to emit light in this way, the spectrum consists of a series of lines and is called and emission spectra (Fig 1.).

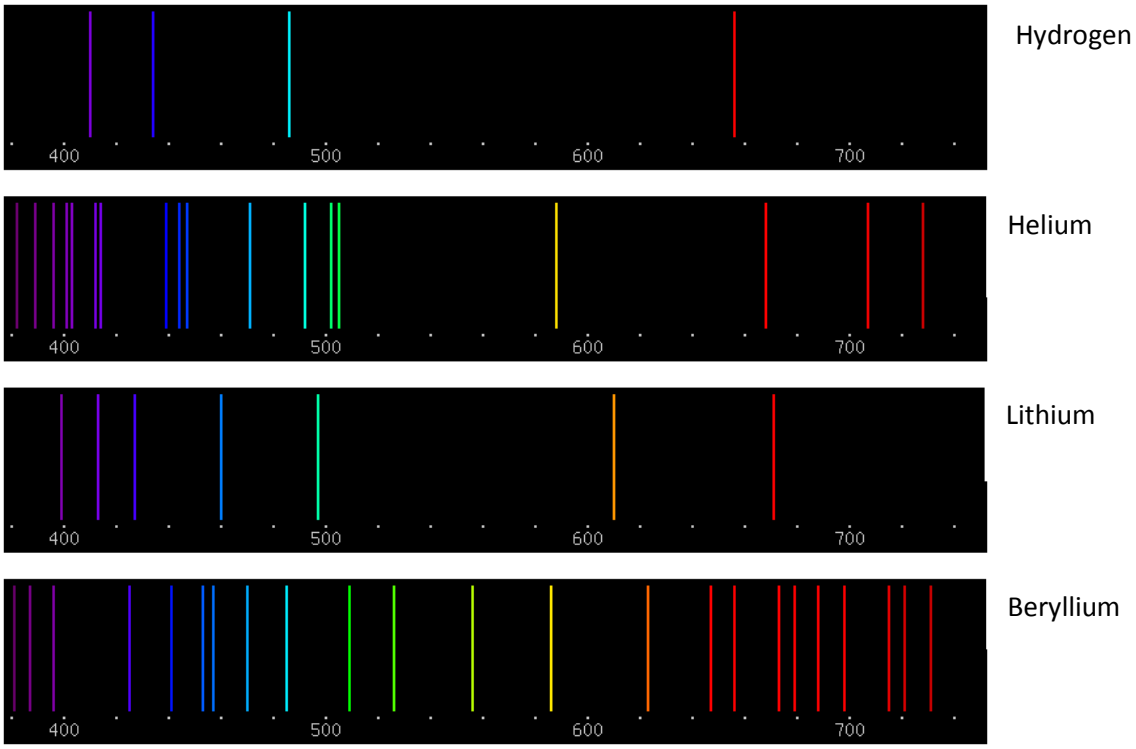

Fig. 1 Emission spectra for hydrogen, helium, lithium and beryllium.

A number of chemical compounds can produce emission spectra when introduce into the flame of a Bunsen burner imparting a characteristic color to the flame. In fact, the kind of color given off by each atom is so exact that it can be used to identify that atom. In the samples that we are going to study, only the metal atoms produce a color that can be observed when they are excited by the Bunsen burner flame. The other part of the molecule does not produce any visible spectra that can be seen by the ordinary eye.

In this experiment we will be working with salts made from metals in groups IA and IIA. The flame test works very well for most of the chloride salts made with the metals from these 2 groups, but you should be aware that not all atoms and compounds give flame colors. Table 1. gives you a general idea of the colors that you will be observing, but use your own words when describing what you see.

Table 1. Flame Test Colors for Some Cations

Atom	Flame Color
Lithium	Red
Sodium	Yellow-orange
Potassium	Light purple
Rubidium	Red-violet
Cesium	Blue-violet
Calcium	Orange-red
Strontium	Red
Barium	Green

PROCEDURE

A. Flame tests for Known Metallic Ions

1. Fill a 150 mL beaker with about 100 mL of deionized water. Take about 8 wood sticks from the communal container and place them in your 150 mL beaker. It is important that you maintain the sticks wet.
2. Place about 10 drops of each of the following solutions into a corresponding depression of a spot plate: LiCl, NaCl, KCl, $CaCl_2$, $SrCl_2$ and $BaCl_2$.
3. Light the Bunsen burner and make sure to have it with both the outer and inner cones visible as in Figure 2.
4. Dip the end of one your applicator sticks in one of the samples in your spot plate and let it soak for about 20 seconds.
5. Place the tip of the sample-soaked wood applicator just at the upper tip of the inner blue cone of the flame as in Figure 2. Observe and record the color of the flame.
6. Repeat the test for the other 5 chemicals using a new applicator stick.
7. Discard the used applicator in the appropriate waste container. It is labeled "SOLID INORGANIC WASTE," "LiCl, NaCl, KCl, $CaCl_2$, $SrCl_2$ and $BaCl_2$."
8. Discard the liquid chemical samples in your spot plates in the OTHER appropriate waste container labeled "AQUEOUS INORGANIC WASTE," "Li^+, Na^+, K^+, Ca^{2+}, Sr^{2+}, Ba^{2+}. Use a water bottle if necessary to remove all chemicals from the spot plate.

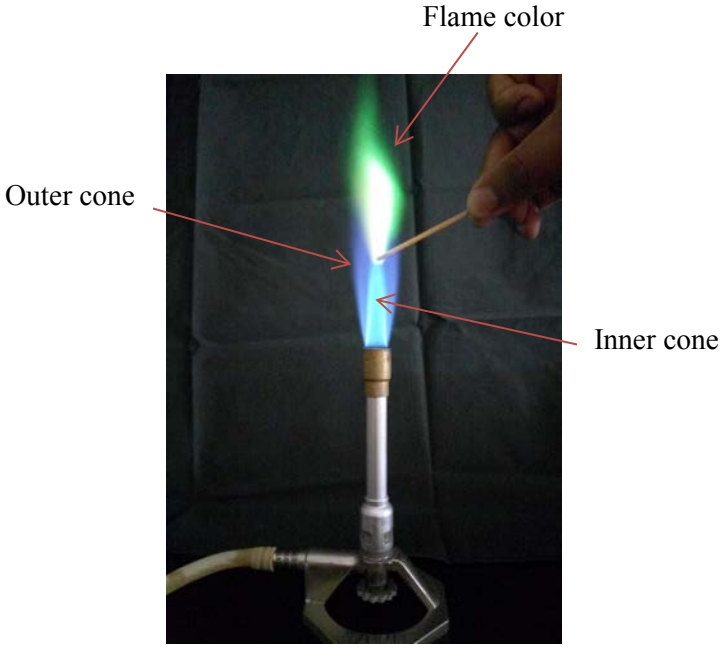

Fig. 1 Flame test for copper (II).

B. Flame tests for Unknown Metallic Ions

1. Take 3 unknown samples from your instructor. Make sure to record the unknown numbers.
2. Identify the unknowns using the steps in Part A.
3. If there is doubt about the identity of one of your unknowns, run both your unknown and the known samples simultaneously and compare. If the flames are the same, then your unknown is the same. If it is not, then test another.
4. Make sure to record the observed flame color for each of your unknowns.

Name_____

Partner's name _____

Date_____

DATA

A. Flame Test of Known Metallic Ions

a. Li^+ _____

b. Na^+ _____

c. K^+ _____

d. Ca^{2+} _____

e. Sr^{2+} _____

f. Ba^{2+}

B. Flame Test of Unknown Metallic Ions

Unknown Number	Metallic Ion Present
_____	_____
_____	_____
_____	_____