

Experiment 47



Flame Tests

Problem

Can we identify an unknown mixture by using a flame test?

Introduction

Flame tests provide a way to qualitatively test for the presence of specific metallic ions. The heat of the flame excites the electrons in the metal ion, and this energy is released as the electrons “fall back” to their ground states. The color we see is a combination of the visible wavelengths of light emitted by the ion.

In this lab you will perform flame tests on seven different metal ions. You will use your observations to identify two unknown solutions.

Prelaboratory Assignment

- ✓ Read the entire experiment before you begin.
- ✓ Answer the Prelaboratory Questions.
 1. Why must the nichrome wire be cleaned thoroughly between each flame test?
 2. Why do we see colors in the flame tests, and why are there different colors for different metal ions?

Materials

Safety goggles

Lab apron

Nichrome wire loop

Well plate with solutions

Bunsen burner

Wash bottle with deionized water

6.0 M HCl

Seven watch glasses (or petri dishes)

Solutions of the following salts:

barium nitrate

calcium nitrate

copper(II) nitrate

lithium nitrate

potassium nitrate

sodium chloride

strontium nitrate

Safety



1. Safety goggles and a lab apron must be worn at all times in the laboratory.
2. Many of these salts are toxic. If you come in contact with any solution, wash the contacted area thoroughly.
3. The 6.0 M HCl is corrosive. Handle it with extreme care.

Procedure

1. Clean the nichrome wire. First, rinse with deionized water. Next, dip the loop into the 6.0 M HCl solution. Place the loop into the flame of the Bunsen burner for about a minute. Pay attention to the color of the clean nichrome wire in the flame.
2. Place a small amount of each solution in separate watch glasses.
3. Perform a flame test on each solution by first heating the loop of the nichrome wire in the Bunsen burner. Hold the watch glass with the solution to be tested next to the intake of the Bunsen burner and place the hot loop into the solution. Make careful observations of the flame of the Bunsen burner and record your observations.
4. Clean the wire as described in step 1, and test each of the remaining six solutions separately.
5. Obtain two unknown solutions from your teacher and perform flame tests on each (cleaning the wire between unknowns). Record all observations.



Cleaning Up

1. Clean up all materials (make sure the nichrome wire is clean).
2. Dispose of all chemicals as instructed by your teacher.
3. Wash your hands thoroughly before leaving the laboratory.

Analysis and Conclusions

Complete the **Analysis and Conclusions** section for this experiment either on your Report Sheet or in your lab report as directed by your teacher.

1. How does the flame test provide support for quantized energy levels? Explain your answer.
2. List the metal ions present in your two unknown solutions and provide reasons.

Something Extra

Does the anion in a salt affect the color observed in a flame test? Design an experiment to answer this question, discuss it with your teacher, and try it.