

Flame Tests

PROBLEM

How can flame tests be used to identify metal ions?

INTRODUCTION

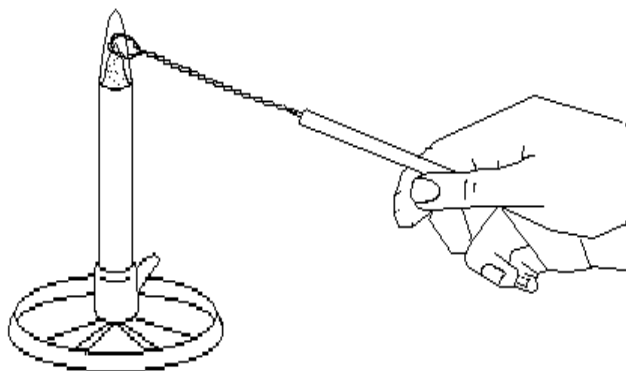
When metals are heated, their outer electrons become excited and jump up to higher energy levels. These energized electrons are not stable at higher energy levels so they fall back down to their normal energy level, giving off their extra energy as light. As a result, metals impart characteristic colors to a flame. In this laboratory exercise, you will observe the colors several metals impart to a flame. Then you will use this information to identify a few unknown metals.

MATERIALS (per group)

Bunsen burner; beaker; metal solutions (barium, calcium, lithium, potassium, sodium, strontium); nichrome wire loop; hydrochloric acid; safety goggles; unknown solutions

PROCEDURE

1. Put on safety goggles. Fill the bottom of a small beaker with dilute hydrochloric acid. Light your Bunsen burner.
2. Clean a nichrome wire loop by dipping it into the beaker of hydrochloric acid. Then hold the loop in the hottest part of the flame (at the tip of the cone) as shown below until it imparts very little color to the flame. If necessary repeat the procedure.



3. Dip the clean nichrome wire loop into one of the metal solutions. Place the tip of the loop in the hottest part of the flame as shown above.
4. Observe the color imparted to the flame by the metal solution. Record your observation in the data table on the next page.
5. Repeat steps 2 through 4 of the procedure with each of the remaining metal solutions.
6. After you have completed your observations with each of the metal solutions, repeat steps 2 through 4 of the procedure with each of the unknown solutions.
7. Each of the unknown solutions contain one or more of the metal ions you examined above. Based on the color imparted to the flame, identify the metals present in each of the unknown solutions. Record the identity of the unknowns in the data table on the next page.

OBSERVATIONS

SOLUTION	COLOR	IDENTITY OF UNKNOWN
Barium		
Calcium		
Lithium		
Potassium		
Sodium		
Strontium		
Unknown 1		
Unknown 2		
Unknown 3		

CONCLUSIONS

1. How can flame tests be used to identify metal ions? _____

2. What part of the atom gains energy from the flame and then loses it in the form of light?

3. Regardless of how hot the flame is, when a metal ion is placed in a flame, it always give off the same color light. Why? _____

4. A kitchen worker at a local hospital was filling salt shakers. For those patients on a sodium restricted diet due to high blood pressure, the hospital provided a salt substitute containing potassium chloride instead of sodium chloride. Unfortunately, the hospital worker mixed some of the containers up. How could the contents of the containers be identified? Give details. _____

5. What do flame tests show about the structure of atoms? (Refer to electrons and energy levels in your answer.) _____

