

Chapter 4 Atomic Structure**Forensics Lab****Using Flame Tests**

Forensic scientists use various approaches to distinguish substances. When some substances 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, these substances impart characteristic colors to a flame. In this lab, you will observe the flame colors of several substances and use the data to determine the identity of an unknown substance.

Problem How can the color of the flame be used to distinguish substances?

Independent Variable _____

Dependent Variable _____

Materials

- solutions of calcium chloride, boric acid, potassium chloride, copper(II) sulfate, sodium chloride, and various unknowns.
- Bunsen burner
- wood splints soaked in water
- wash bottle with distilled water

Skills

Observing, Predicting, Using Data Tables

Safety

Goggles, using acid, handling glassware, poisonous chemicals, open flame

Procedure**Part A: Observing Flame Colors**

1. Light the Bunsen burner. **CAUTION:** *Put on safety goggles. Tie back loose hair and clothing before working with a flame.*
2. Dip wood splints into calcium chloride solution and then place the splint in the flame. Observe and record the color of the flame in the data table.

3. Repeat step 2 with each of the other solutions. Be careful not to transfer any solution from one container to another.

CAUTION: *These chemicals are poisonous. Do not let them get on your skin.*

Part B: Examining an Unknown Solution

4. Repeat step 2 with each of the unknown solutions. Compare your observations with the other data that you recorded to identify the unknowns.
5. Make sure Bunsen burner has been turned off.
- CAUTION:** *Wash your hands thoroughly before leaving the laboratory.*

Data Table

Solution	Flame Color
Calcium chloride	
Potassium chloride	
Boric Acid	
Copper(II) sulfate	
Sodium chloride	
Unknown A	
Unknown B	
Unknown C	
Identity of unknown A	
Identity of unknown B	
Identity of unknown C	

Analyze and Conclude

1. **Comparing and Contrasting** Is there a relationship between the color of the flame and the color of the solution?

2. **Formulating Hypotheses** How do these substances produce light of different colors?

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

4. 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

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

6. **Drawing Conclusions** A forensic scientist does a flame test on a substance that was found at a crime scene. What might the scientist conclude if the flame turns green?
