

Chapter 28: Color

Atomic Spectra

75

Flaming Out

Purpose

To observe the spectra of some metal atoms

Required Equipment/Supplies

safety goggles	7 20-cm pieces of platinum or nichrome wire with a small loop at one end
spectroscope	
incandescent lamp	
Bunsen burner with matches or igniter	6 labeled bottles containing salts of lithium, sodium, potassium, calcium, strontium, and copper
small beaker	

Discussion

An element emits light of certain frequencies when heated to high enough temperatures. Different frequencies are seen as different colors, and each element emits (and absorbs) its own pattern of colors. This allows us to identify these elements, whether they are nearby or far away.

Procedure 

Step 1: Practice using the spectroscope by looking at an incandescent lamp. The spectrum will appear as a rainbow of colors. Adjust the spectroscope until the spectrum is horizontal and clear.

Adjust spectroscope.

Step 2: Put on safety goggles. Ignite the Bunsen burner. Adjust it until a blue, nearly invisible flame is obtained.

Step 3: Dip a loop of wire into the bottle of solid sodium chloride. Hold the loop in the flame until the sodium chloride melts and vaporizes. Observe the spectrum of the sodium atoms through the spectroscope. You may also see a long, broad band image due to the glowing wire. Ignore this image. In Data Table A, sketch any major lines you see, in the appropriate position, for the color of the lines.

Step 4: Test each of the other salts as in Step 3. Each wire is to stay in its proper bottle. Mixing the test wires contaminates them. If you should make a mistake and place a wire in the wrong bottle, burn off all the salt until the wire glows red hot, then return it to its proper bottle. In Data Table A, sketch the major lines emitted by each salt.

Sketch spectral lines.

Data Table A

Salt of:	Major Spectral Lines				
	Red	Yellow	Green	Blue	Violet
Lithium					
Sodium					
Potassium					
Calcium					
Strontium					
Copper					

Observe spectrum of mixture.

Step 5: Mix small and equal amounts of the copper and lithium salts in the small beaker. Using the extra test wire, hold a loopful of the mixture in the flame, and observe the resulting spectrum through the spectroscopy.

1. Does the spectrum of the mixture of copper and lithium salts contain a combination of the copper and lithium lines?

Step 6: Mix a trace of lithium salt with a larger amount of copper salt. Observe the resulting spectrum through the spectroscopy, using the same wire.

2. Did you see the characteristic colors of both copper and lithium?

Analysis

3. How do you know that the bright yellow lines you observed when looking at sodium chloride are due to the sodium and not to the chlorine in the compound?

4. From your observations in Steps 5 and 6, draw conclusions about the relative amounts of metal elements present in each mixture.

5. In steel mills, large amounts of scrap steel of unknown composition are melted to make new steel. Explain how the laboratory technicians in the steel mills can tell exactly what is in any given batch of steel in order to adjust its composition.
