

8.2 Flame Tests

Subjects: Atomic structure

Description: Alcoholic solutions of salts are burned to illustrate that different wave lengths of light are emitted by different materials.

Materials:

For A:	For B:
Plastic spray bottles with solutions	NaCl (yellow)
Meeker burner*	SrCl ₂ (red)
Butane lighter or striker*	KCl (violet)
Isopropanol/water containing:	CuCl ₂ (green)
Sodium Chloride (NaCl - yellow)	CaCl ₂ (red-orange)
Strontium Chloride (SrCl ₂ - red)	H ₃ BO ₃ (pale green)
Potassium chloride (KCl - violet)	Spatula
Copper Chloride (CuCl ₂ - green)	5 Petri dishes with covers
Calcium Chloride (CaCl ₂ - red-orange)	Methanol‡
Lithium Chloride (LiCl - Red)	Lighter
Boric Acid (H ₃ BO ₃ - pale green)	
Blank	

*Shared item. Located in the top drawer opposite the storage shelves.

‡Located in Flammables cabinet

Procedure A: Spray Bottles

1. Light the burner
2. Dim the lights
3. Spray salt solution into flame of burner.
4. Observe colors

Procedure B: Petri dish method

1. Sprinkle a spatula full of each salt into separate Petri dishes.
2. Cover salt with methanol (10 mL).
3. Turn off the lights for a better visual effect.
4. Use the lighter to start up the flame for each sample.
5. To extinguish the flame, put the cover over the Petri dish and let cool before removing.

Discussion:

When an element is burned, the electrons are excited. As the electrons from an excited state relax back to a ground state, they will emit photons of light. These photons will have different colors depending on the element and its discrete energy

levels. That is, different wavelengths of light (colors) will be emitted when the electrons of different elements go down the step(s) between their energy level(s). Each element will have its own set of steps therefore each will have its own color.

Safety: Wear safety glasses and goggles while preparing and during the demonstration. Be sure to allow time for the cover to cool before removing.

References:

1. NCSU Department of Chemistry Lecture Demo web site
<http://www.ncsu.edu/project/chemistrydemos/DemoList.html>
2. A.M. Landis, M.I. Davies, L. Landis; *J. Chem. Ed.*; 2009; 86; 577