Flame Test Demonstration

Flame Tests

Introduction

Just as a fingerprint is unique to each person, the color of light emitted by metals heated in a flame is unique to each metal. This simple demonstration is a great starting activity to begin discussions about absorption and emission.

Concepts

- Flame Tests
- Absorption/Emission

Materials

Copper carbonate, 5 g
Lithium carbonate, 5 g
Potassium carbonate, 5 g
Vinegar, 100 mL
Bunsen burner
Ceramic fiber squares, 3
Lighter, butane, safety
Petri dishes, borosilicate glass, 3

Safety Precautions

Potassium carbonate is a body tissue irritant. Lithium carbonate is corrosive to eyes and respiratory tract and is moderately toxic. Copper carbonate is slightly toxic by ingestion and inhalation. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Follow all laboratory safety guidelines. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Place approximately 5 g of copper carbonate into a borosilicate glass Petri dish.
2. Place approximately 5 g of lithium carbonate into a borosilicate glass Petri dish.
3. Place approximately 5 g of potassium carbonate into a borosilicate glass Petri dish.
4. Dim the lights.
5. Light the Bunsen burner. Adjust the flame to blue.
6. Pour vinegar on the carbonate.
7. Place the Bunsen burner flame in the region of the rising gas and observe.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. The waste solutions may be disposed of using Flinn Suggested Disposal Method #26b, down the drain with an excess of water.

Tips

- Avoid mixing the various solids. If mixing occurs, the flames observed will either be mixtures of the two colors, or one of the colors will mask the other.
- Have students look at the flames through a diffraction grating or piece of Flinn C-Spectra® to observe the line emission spectra for each metal. Each element has a unique line emission spectrum. Students can sketch the line emission spectrum for each metal, and then use the spectra to identify unknowns.
- A similar activity, the Flame Test Kit (Catalog No. AP5607), is available from Flinn Scientific and is a student

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laboratory kit using wooden splints and metal salts to demonstrate absorption and emission.

Discussion

If an element can be placed in solution and that solution is burned, then the element's electrons will absorb energy. This process is sometimes called "exciting" the electrons. As the excited electrons return to their normal or "ground" state, energy is emitted in the form of electromagnetic radiation. Simply stated: if an electron is excited via heat, that electron will become excited and emit light as it returns to its ground (non-excited) state. (See Figure 1.)

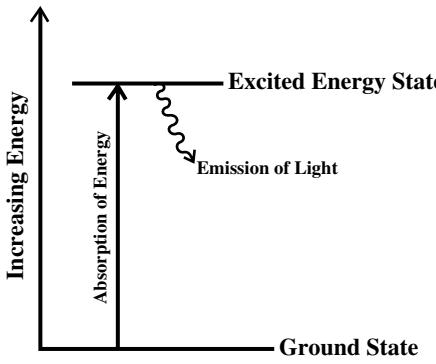

Figure 1.

Results

Metal Ion	Flame Color
Cu^{2+}	green
Li^{+}	bright red
K^{+}	violet
Na^{+}	yellow
Sr^{2+}	red–orange

Every element emits a characteristic light. Just as a fingerprint is unique to each person, the color of light emitted after excitation of an element is unique to that element. Only a few elements give off a characteristic light in the visible region of the spectrum. The visible region of the spectrum is that which is visible to the human eye (400–700 nm). For most elements, the characteristic color is detectable only in the ultraviolet or infrared region of the spectrum. The spectrum produced from exciting one element contains only specific wavelengths and is called a line spectrum (see Figure 2). The lines are due to the different excited electrons returning to their lower energy ground states. Since each element has a specific group of electrons and energy levels, the wavelengths given off by the falling electrons can be used to identify an element.

Sample Emission Line Spectra

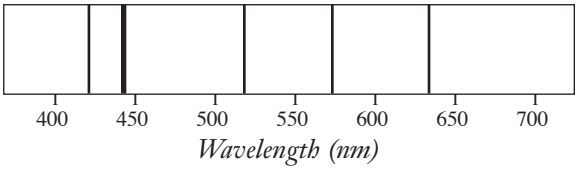

Figure 2.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12
Evidence, models, and explanation

Content Standards: Grades 5–8
Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12
Content Standard B: Physical Science, structure and properties of matter

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of the *Flame Test Demonstration* activity, presented by Penney Sconzo, is available in *Flame Tests*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *Flame Test Demonstration* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP5607	Flame Test Kit—Student Laboratory Kit
C0211	Copper Carbonate
L0094	Lithium Carbonate
P0157	Potassium Carbonate
V0005	Vinegar

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.

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