

## CHEM LAB: EMISSION SPECTROSCOPY and FLAME TESTS

WHAT TO TURN IN: Hypothesis, Data Table 1, Data Table 2, Questions
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### Objectives

- To observe the spectra from different sources of light
- To compare the spectra from different sources of light
- To compare and contrast flame tests of different solutions of common ions

### Introduction

All atoms give off *electromagnetic (em) radiation* if their gases are energized by heating or by a high voltage electric discharge. If the light emitted by a gas is passed through a *spectroscope*, a pattern of narrow bands of light is produced. This pattern is a type of discrete spectrum called an *emission spectrum* or *bright line spectrum*. Each bright line represents an energy bundle. Each element will produce its own unique pattern, like a fingerprint. An incandescent light bulb (IL) produces a *continuous spectrum*, and it shows one blended rainbow effect when viewed through a spectroscope.

The unique pattern of light emitted by an energized atom corresponds to a set of energies released as electrons drop from the higher energy levels of the *excited state* to lower energy levels of the *ground state*. Electrons in the excited state are unstable and cannot remain at the higher level. As the electron drops back to the lower, more stable energy level, it emits a *photon*, a bundle of light energy which is related to specific colors. This can also be shown by *flame tests*, in which solutions of ions can be tested for the appearance of colors in the flame of a burner.

**Hypothesis:** Write an if-then statement based on the information in the introduction.

### Procedure – Part 1, Spectroscopy

- 1) Using a spectroscope, examine the spectrum emitted by a low-wattage incandescent bulb. Draw the spectrum in the Data Table 1.
- 2) Using a spectroscope, examine the spectrum emitted by a fluorescent bulb. Draw the spectrum in the Data Table 1.
- 3) Repeat with the other gases in high-voltage lamps. Do not touch the high-voltage lamps except to turn them on or off.

### Procedure – Part 2, Flame Tests

- 4) Obtain a wooden splint that has been soaking in a solution of a specific ion. Place the wooden splint into the edge of the flame of the burner. Record the color of the flame in Data Table 2.

### Questions

- 1) What is meant by an “energized” or “excited” gas?
- 2) Compare and contrast the spectrum from the incandescent light bulb with the spectrum from the fluorescent light bulb.
- 3) Would you expect red light to have a wavelength closer to 4000 or 7000? Why?
- 4) Would you expect violet light to have a wavelength closer to 4000 or 7000? Why?

### DATA TABLE 1 – SPECTROSCOPY

Directions: Color in the bands you see at the appropriate places, using colored pencils or thin markers.

INCANDESCENT BULB (standard light bulb)

4000	5000	6000	7000
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FLUORESCENT BULB (ceiling)

4000	5000	6000	7000
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HELIUM (He)

4000	5000	6000	7000
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NEON (Ne)

4000	5000	6000	7000
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MERCURY (Hg)

4000	5000	6000	7000
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### DATA TABLE 2 – FLAME TESTS

ION NAME	SYMBOL AND CHARGE	COLOR OF FLAME
<b>Barium</b>	<b>Ba<sup>2+</sup></b>	
<b>Copper (II)</b>	<b>Cu<sup>2+</sup></b>	
<b>Potassium</b>	<b>K<sup>+</sup></b>	
<b>Sodium</b>	<b>Na<sup>+</sup></b>	
<b>Lithium</b>	<b>Li<sup>+</sup></b>	
<b>Strontium</b>	<b>Sr<sup>2+</sup></b>	