**Atomic Spectra Lab**

*Each type of atom has a unique set of electrons, each with a specific ‘orbit’. As each electron is energized, it emits a distinct wavelength and therefore, frequency of light. The set of light frequencies produced is in effect the ‘fingerprint’ of an element.*

*One method for producing emission spectra is by introducing a volatile salt of an element, CaCl2 for example, into a Bunsen burner flame. These* ***flame tests*** *result in a colored flame that is the sum of all the wavelengths emitted by the excited electrons.*

*In order to see separate light wavelengths produced, the light must be passed through the diffraction grating (grooved plastic film) of a spectrascope. Like prisms, spectrascopes use refraction to break up light. The wavelengths of light appear as colored bands on a black background, called the elements* ***emission spectrums****. There are many applications for spectral analysis, not the least of which is identifying the elements present in stars and other distant objects.*

**Part A: Emission Spectra**

**Objective:**

Identify how astronomers can determine which elements exist in the sun and other stars.

**Hypothesis:**

**Procedure**

1. Observe the elements in the gas tubes as they are energized in the spectrometer. Note the overall color of the continuous spectrum produced. Record.
2. View the energized gas using a spectrum. Using colored pencils or markers, record the emission spectra you see on the data tables provided. Estimate the position of each line relative to one another and based on the wavelength data provided.

 **Data A:**

Light Source:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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Light Source:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**R O Y G B I V**

**Part B: Flame Tests**

**Objective:**

Determine the colors produced by various volatile salts.

**Hypothesis:**

**Procedure:**

1. Put goggles on and clear your work area of any unnecessary items.
2. Use striker to light Bunsen burner. Adjust so flame is clear blue
3. Place the inoculation loop in the Bunsen burner flame to clean.
4. Dip the inoculation loop in the water and then dip in the chemical salt. Tap off any excess.
5. Burn the salt off the loop in the flame and note color change to flame. Record.
6. Rotate stations as directed by the teacher.

 **Data B:**

|  |  |  |
| --- | --- | --- |
| **Compound Name** | **Formula** | **Flame color** |
| Potassium Chloride | KCl |  |
| Calcium Chloride | CaCl2 |  |
| Lithium Chloride | LiCl |  |
| Strontium Chloride | Sr Cl2 |  |
| Sodium Chloride | NaCl |  |
| Barium Chloride | BaCl |  |
| unknown |  |  |

**Analysis**

What happened when you burned the salts and energized the gases? Cite examples. Infer at an atomic level. Discuss difficulties and error, conclusiveness.

 **Atomic Spectra Follow-up (A)** *Answer on this paper. Do not attach to lab notebook*

1. Which colors of the visible spectrum (ROYGBV) have the most energy? The least?
2. Which colors have the longest wavelength? The shortest?
3. Which colors have the highest frequency? The lowest?
4. Write a caption under each picture to explain how atoms can produce light.
5. Which electron would release more energy; one falling back from a second shell or a third shell? Why?
6. What color might be associated with a fall from a high distance? From a low distance?
7. Why do different atoms produce different colors of light?
8. Why are emission spectra called the ‘fingerprints’ of the elements?
9. Your neighbor is excited about what he calls his new decorative neon light s for his room – one is blue and one is orange. Are there really neon lights? Explain.

**Atomic Spectra Follow-up (H)** *Answer on this paper. Do not attach to lab notebook.*

1. Which colors of the visible spectrum (ROYGBV) have the most energy? The least?
2. Write a caption under each picture to explain how atoms can produce light.
3. Which electron would release more energy; one falling back from a second shell or a third shell? Why?
4. What color might be associated with a fall from a high distance? From a low distance?
5. Why do different atoms produce different colors of light?
6. What is different about the chemicals viewed in part A compared to those used in part B?
7. Why are emission spectra called the ‘fingerprints’ of the elements?
8. Your neighbor is excited about what he calls his new decorative neon light s for his room – one is blue and one is orange. Are there really neon lights? Explain.
9. Do different atoms give off different colors of light when their electrons are energized?