

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Section: \_\_\_\_\_

## Astron 104 Laboratory #9

### Spectral Analysis

#### Section 2-5–2.8, 10.3

In this exercise, you will learn how to identify various chemical elements by observing their emission line spectra. There will be a total of 5 elements to identify in this manner. Your data will be recorded on the data-sheet provided.

Note: in this exercise, wavelength is measured in Angstroms ( $\text{\AA}$ ).  $1 \text{ \AA} = 10^{-8} \text{ cm}$ , or about the size of a hydrogen atom. The visible portion of the electromagnetic spectrum runs from about  $4000 \text{ \AA}$  to  $7000 \text{ \AA}$ . The data boxes are about  $15 \text{ cm}$  long, so the scale is about  $200 \text{ \AA/cm}$ .

### Part 1: The Reference Spectrum

You will first need to establish a reference spectrum to determine the relative positions of the colors. A continuous visible spectrum will be projected for this purpose.

#### Procedure

1. Place the first (top) data box under the projected continuous spectrum. Adjust the position of your paper so that the colors fill the box, with the violet and red ends matching the labels on the data box.
2. On your projected continuous spectrum, using a pencil, indicate the apparent boundaries between each of the following colors: Red, Yellow, Green, Blue, and Violet.
3. Using the colored pencils provided, lightly color the spectrum in the data box to match the colors of the projected spectrum.
4. Draw a heavier line with the colored pencil in the middle of each color.
5. Using the scale of  $200 \text{ \AA/cm}$ , estimate the mid-point wavelength for each of the following colors:

	Red	Yellow	Green	Blue	Violet
Midpoint Wavelength					

When you have completed the reference spectrum, you may move on to the other work stations to observe the spectra of the unknown elements. You do not have to make these observations in any specific order. Just make sure that you record your observations in the proper data box for each unknown element.

## Part 2: The Line Spectra of Unknown Elements

You will now observe the line spectra of 5 different elements using a spectroscope. These line spectra are produced by a glowing gas which radiates energy at specific wavelengths characteristic of the element the gas is made of. These spectra consist of a number of bright lines against a dark background.

**CAUTION:** The apparatus which produces these spectra operates at a very high voltage. Be careful not to touch the apparatus while it is turned on.

### Procedure

1. Observe the line spectrum of the unknown element.
2. As accurately as possible in terms of color and relative position in the spectrum, draw with the colored pencils provided the spectral lines that you observe. Refer to the reference spectrum you produced in Part 1 to position the lines appropriately.
3. Repeat the above steps for each of the 5 unknown elements.

## Part 3: Identifying the Unknown Elements

You will now identify each of the unknown elements by comparing the line spectra you drew for each of them with the standard line spectra for various elements.

### Procedure

1. For each data box, compare the spectrum you drew with the line spectra shown on the Spectrum Chart in the front of the room.
2. After finding the best match, indicate on the attached sheet what you believe the element you observed to be.

3. Repeat the above steps for each element that you observed.

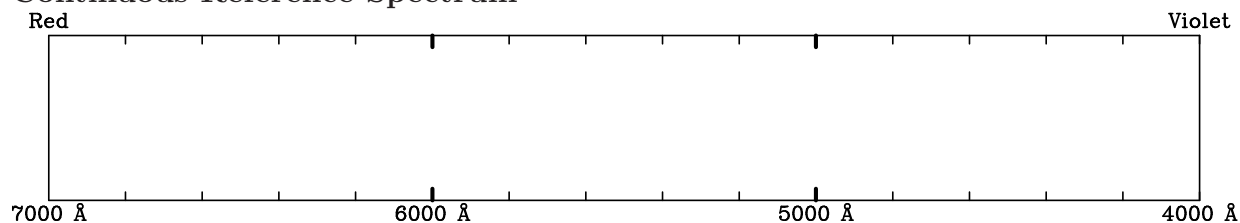
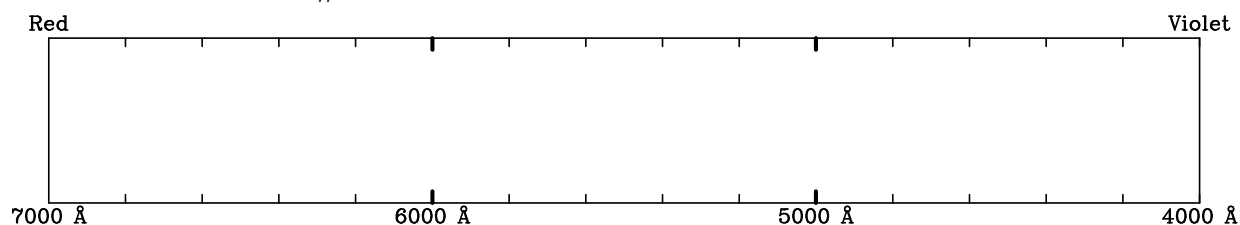
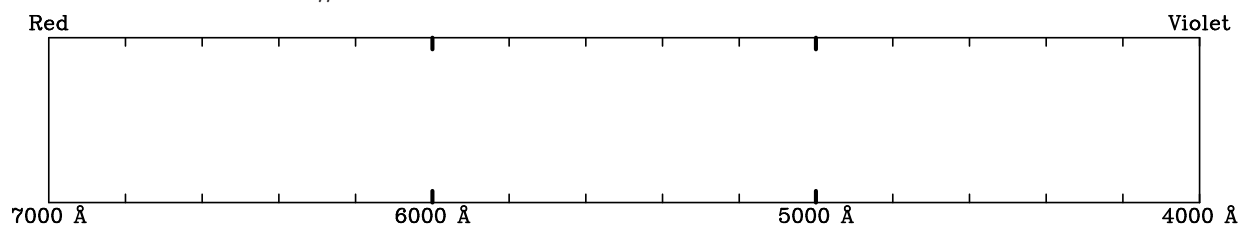
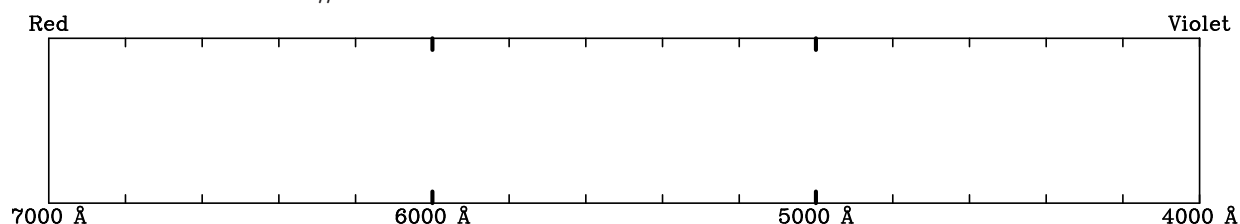
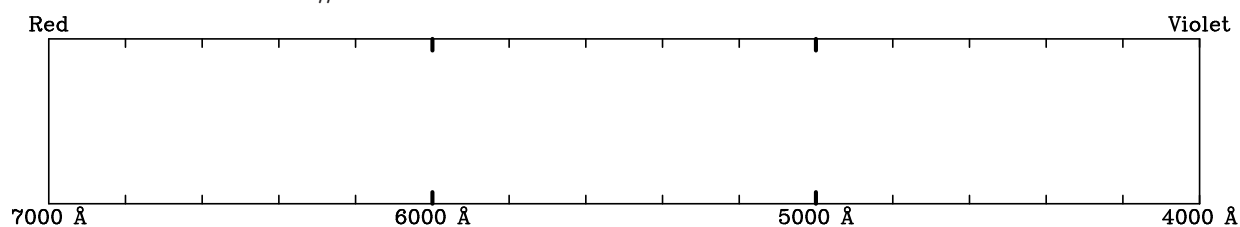
Note: if any of your observed spectra do not match any of the standard spectra on the chart, go back and re-observe. You may do this as many times as you need (time permitting).

## Part 4: Results

Unknown Element #1	
Unknown Element #2	
Unknown Element #3	
Unknown Element #4	
Unknown Element #5	

Several of the glowing gases you observed are commonly seen in everyday situations. Which gases were they?

**Important Final Note:** Be sure to attach your Data Sheet to your assignment before you turn it in. You might also want to write your name on the Data Sheet for extra security.

**Continuous Reference Spectrum****Unknown Element #1****Unknown Element #2****Unknown Element #3****Unknown Element #4****Unknown Element #5**