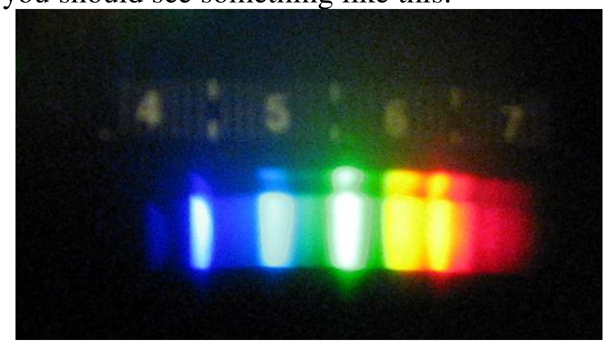
SPECTROSCOPY

These small spectroscopes have a diffraction grating that disperses or spreads the light out so the different colors and wavelengths can be seen independently (much as a prism does). A scale is attached so the positions of the colored images of the light source can be quantitatively recorded. When viewing through the spectroscope roughly align the slit at the fat end with the light source you want to study. When looking at one of the discharge lamps through the hole at the skinny end of the spectroscope, you should see something like this:



I. To get a feeling for how to use a spectroscope to identify the source of the light, we must first calibrate the spectroscope by looking at the light from known sources. First of all, observe the "Known Sources" containing Mercury vapor and Hydrogen. Three bright lines in each of these sources' spectra shall be observed. Note and record the scale position of the three indicated lines:

Calibration Data Table			
HYDROGEN	Violet	Blue-green	Red
Scale Position			
Wavelength:			
MERCURY	Violet	Blue-green	Red
Scale Position			
Wavelength:			

Since we "know" what atoms are present in these sources, the wavelengths at which spectral lines can be seen are also known. A table of some prominent, known wavelengths for five different elements is listed below. The relationship between color and wavelength is shown in your textbook.

Hydrogen	Helium	Neon	More Neon	Mercury	Sodium
410nm	447	454	603	405	589
434	469	470	607	436	590
486	502	475	614	546	
656	588	483	616	579	
	668	489	622	615	
		496	627		
		534	633		
		540	640		
		585	651		
		588	660		
			693		

Note that there may be more wavelength values in the table than there will be recorded scale positions. From the colors of the known lines, select the three corresponding wavelength values and enter them in the wavelength row below their respective colors in your calibration data table.

Now prepare a calibration graph. For the data you took, plot Wavelength (vertical axis) vs. Scale Position (horizontal axis). If your spectrometer scale were ideal, this would be a straight line with a slope of one hundred. From YOUR graph the wavelength corresponding to scale positions can be determined. In each of the following steps, observe and record the spectrum scale positions and then use your line to determine their associated wavelength value in nanometers.

II.Applications

The set of wavelength values is a unique characteristic of an element. Here we shall observe some "unknown" sources and note positions of bright lines in their spectra. Use your graph to determine the corresponding wavelengths. Now compare your SET of measured wavelength values with the table of known values. Since some elements e-mail like close in wavelength to other elements, we can use the pattern of a set of lines to uniquely identify which element is present in a given light source. Whichever set, not just an individual value but rather the group of values, of these known wavelengths best fits with your unknown set can be used to identify the element.

A. Observe the "unknown" gas discharge tube. Again, note the positions of (at least three) bright lines in its spectrum and enter them in the table below. From your calibration graph, determine roughly what the corresponding wavelengths associated with these lines are and identify the element present.

Scale Positions:			
Wavelengths:			
Element:			"

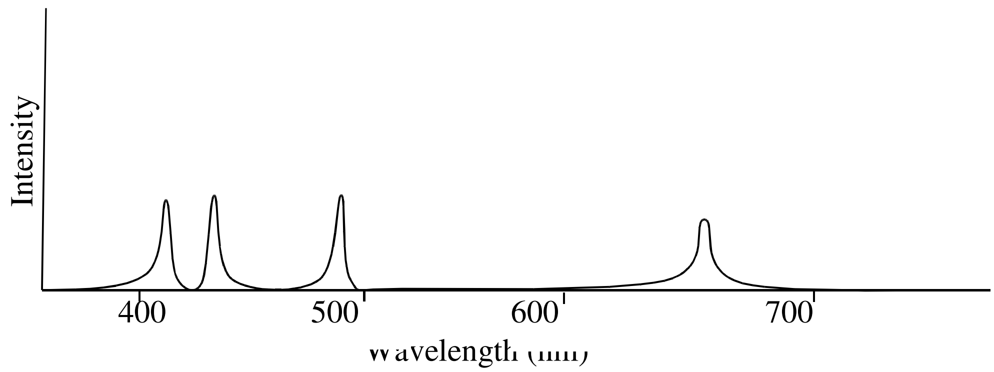
B. From several meters away, observe the spectrum for the lights out in the hall. Note line positions in the table below. From your calibration graph, determine roughly what the corresponding wavelengths are and identify the element present.

Scale Positions:			
Wavelengths:			
Element:			

C. Another very yellow light is situated in this room. Identify the element(s) in this lamp.

Scale Positions:			
Wavelengths:			
Element:			

D. Another way to represent a spectrum is to show a graph of the intensity (brightness) versus wavelength. Such a graph of the hydrogen spectrum is sketched below.



On the grid below, make a careful sketch of a graph that would represent the spectrum you saw for the Mercury discharge lamp. Be sure to label both axes and include a numerical scale with units for the wavelengths on the horizontal axis.