Point your spectroscope at the mercury discharge lamp and observe the spectrum. In your lab notebook, record the positions (read from the graph paper taped inside the box) of the observed lines of the mercury spectrum, and record the corresponding wavelength (in nm) of the spectral lines you observe (see Table 1).

D. **Spectrum of Hydrogen**

1. **Using the gas discharge lamps, observe the spectrum of hydrogen.** (The hydrogen lamp is filled with H_2, but the diatomic gas dissociates so that you do observe the atomic spectrum of H and not the molecular spectrum of H_2.) You may find it advantageous to increase the slit width to about 1.5 to 2.0 mm and to view the lamp quite closely, perhaps about 10 to 20 cm away. **In your lab notebook, record the positions of the observed lines (read from the graph paper taped inside the spectroscope). The visible spectrum of hydrogen consists of four lines: a red line, a green line, a blue line, and a violet line. The violet line in the hydrogen spectrum is difficult to see. You may only observe three hydrogen lines using your spectroscope. If you see only three lines, they are the red, green, and blue lines.**

2. Your instructor may have another discharge tube (He, Ne, or another gas) set up for you to observe.

Calculations

A. Calibration of the Spectroscope

Make a calibration curve by plotting positions of the *mercury* spectral lines on the y-axis and known wavelength (in nanometers) on the x-axis using Excel. You should have these data in table form in your lab notebook. Use Excel to calculate and plot the best-fit line through the points.

This plot is the spectroscope calibration line which will enable you to find the wavelengths of unknown spectral lines in any emission spectrum observed with your spectroscope.

B. Spectrum of Hydrogen

Using your calibration curve, convert measured positions to wavelengths (nm) for all of the lines in the hydrogen emission spectrum that you observed. This can be done mathematically, using the slope and y-intercept for the calibration line which you have plotted. In this case the equation for a straight line (eq 2)

$$y = mx + b \tag{2}$$

can be interpreted as (eq 3)

$$\text{Position} = (\text{slope})(\text{wavelength in nm}) + \text{y-intercept} \tag{3}$$

Rearrange and solve for the wavelength of the spectral lines. Treat your observed hydrogen line positions as the y-variable, and solve for the x-variable (wavelength in nm) using the equation of the calibration line calculated from your mercury data.

Calculate the energy (J) of each line in the hydrogen spectrum using eq 1.

Tabulate your results, listing wavelength (nm) and energy (J) for each line observed. Compare your calculated wavelengths with the known values shown in Table 2. Calculate the percent relative error (PRE) for each wavelength observed. Comment on the sources of error in your lab report.