NAME_____ PD._____ DATE_____/_____/_____

PARTNER(S)_____

SPECTRAL ANALYSIS

The first clues to understanding atomic structure appeared when scientists began to study the emission and absorption of light from different elements. Early in the twentieth century, Rutherford was able to provide some detailed explanation of the observed spectra of some elements. From this study came the introduction of spectroscopy and the development of spectral analysis.

An instrument used to detect and study the emission spectra of various substances is called a **spectroscope**. A spectroscope is a simple instrument which contains a prism or diffraction grating. The prism or grating separates the light emitted from a substance into specific energies.

In your last experiment you observed the different colors of metals by flame tests. In this lab you will discover that the spectrum of an element is characteristic of that element. You will study the spectra of different elements and calculate energy values based upon wavelength and frequency of light.

OBJECTIVES:

- to observe the spectra of different elements
- to determine the λ and energy of the spectral lines for the elements tested
- to gain an understanding of energy levels and location of electrons

MATERIALS:

- various spectrum tubes
- spectroscope or C-spectra film
- power supply or high frequency generator

PROCEDURE:

NOTE: Both lab partners may use the same data, but all reports will be done *individually* and *typed*. All lab reports will include your partner's name, a data table, a calculations table, and the answers to the questions found below. Symbols may be handwritten.

1. Carefully insert a gas discharge tube into the power supply or lay the discharge tube on the lab table away from metal fixtures.
2. Turn on the power supply or bring the high frequency generator near the discharge tube.
3. Observe the spectrum of each substance through a spectroscope or C-spectra film. Record the name of the gas and note its spectral lines.
4. Shut off the power supply and repeat steps 1-3 for each substance.
5. Consult your reference table of spectra for the theoretical wavelengths of the sample gases. Record the three most prominent theoretical wavelengths and your three matching observed wavelengths in a data table.

RESULTS:

1. What causes spectral lines?
2. What are some possible errors of your experimental values?
3. How would you compare the accuracy of the flame test to the accuracy of the gas discharge tube?
4. Why do elements have a number of spectral lines?
5. $E = h\nu = \frac{hc}{\lambda}$ where $h = 6.63x10^{-34}\ joule \cdot sec$. In the calculations table, determine the frequency and energy of the most prominent *observed* line in each spectrum.

USEFUL LINKS:

http://www.800mainstreet.com/spect/emission-flame-exp.html
http://people.westminstercollege.edu/faculty/ccline/elements/elements1.html
http://www.colorado.edu/physics/2000/quantumzone/index.html