Name: _____ Date: _____

Lab – Atomic Emission Spectroscopy

Objective: To observe the visible spectra of various gases. To calculate the transitions and colors produce by hydrogen according to Bohr's model of the atom.

Materials:

_____

_____

Equipment:
Power supply, diffraction glasses

Procedure:
Place a diffraction grating in front of your eye and slide or rotate it until you can observe the spectrum lines on either side of the discharge tube. Record the colors and lines you see in a data table such as the one given below.

Example:

Gas	Spectrum 1	Spectrum 2	Spectrum 3	Spectrum 4
Sample	Red – 2 lines (1 weak/1 strong) Yellow – 3 faint lines	Blue – 1 moderate band		

In the above example, lines are seen in two different spectra. Your data table should include space for four spectra. It is recommended you hold your notebook horizontally. Leave plenty of space between gases.

Prelab:
1. Transcribe objective, materials, equipment and procedure into the lab book.
2. Give a brief description of the Rydberg constant and how it was determined.
3. Construct an energy level diagram – make it wide.
4. Draw and label (only those that start from the 7^{th} energy level or lower) the following:
   a. Lyman Series
   b. Balmer Series
   c. Paschen Series
   d. Brackett Series
   e. Pfund Series
   f. Humphreys Series

Analysis/Calculations:

1. Use the equation $\frac{1}{\lambda} = R_{\infty}\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right)$ to determine the wavelength of the light produced by each transition in a hydrogen atom (there are 21 total). R_{∞} is the Rydberg constant. The variable n_i represents the initial energy level (the level the electron started on), and n_f is the final energy level (the level the electron falls to). Please remember to show all work. Remember that once you simplify the equation you will find $\frac{1}{\lambda}$, **not** λ. Give your answers in nanometers.
2. Use the electromagnetic spectrum to match the color seen with its corresponding transition. For each series, give the category of emr (e.g. ultraviolet) to which it belongs.
3. If $R_{\infty} = \frac{E_{\infty}}{ch}$, calculate E_{∞} for hydrogen.
4. Use the Lyman series wavelengths to find the values for E_1 to E_7.