Proving Hydrogen Lab

 In 1885, Johann Balmer was analyzing the spectrum coming from the excitation of hydrogen gas. He noticed that the 4 different spectral lines of visible light seemed to be related to each other. He created an equation for that relationship using empirical data (which means that the equation is based on data NOT theory):

$λ=B\left(\frac{n^{2}}{n^{2}-4}\right)$ where B is a constant.

This equation was only true for the 4 visible lines of hydrogen but other scientists found spectral lines in the infrared (Paschen Series) and ultraviolet (Lyman Series) spectrum as well. So this equation needed to be generalized for all possible spectral lines. In 1888, Johannes Rydberg created that equation:

$$\frac{1}{λ}=\frac{4}{B}\left(\frac{1}{4}-\frac{1}{n^{2}}\right)=R\_{H}\left(\frac{1}{2^{2}}-\frac{1}{n^{2}}\right)$$

Where RH is the Rydberg constant for Hydrogen. The presence of the 4, or 22, implies that the Balmer series is for light given off when electrons drop to the 2nd energy state of Hydrogen.

With this knowledge, your task today is to PROVE that this gas you will be looking at is hydrogen (atomic number of 1). No, you cannot break the tube and light the gas on fire, you must use the materials provided.

**Procedure**: Discuss with your group how you will measure the wavelengths of the different spectral lines of Hydrogen. You will be given meter sticks and a diffraction grating. That is it. You are required to take at least 9 data points of data. Write down what you will do below:

**Data:**

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| Spectral Line color |  |  |
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This is your final formal lab report for the year, so make it a good one. Show me all your steps in your data analysis and show me the results for each step as you analyze and manipulate the data. NO GRAPH NEEDED FOR THIS LAB REPORT. The Lab report will be on **April 9th.**

Post Lab Question:

Shown are four energy levels for an atom along with 6 possible transitions between various energy levels.



Rank these transitions on the frequency of the emitted photons.



Explain your reasoning.