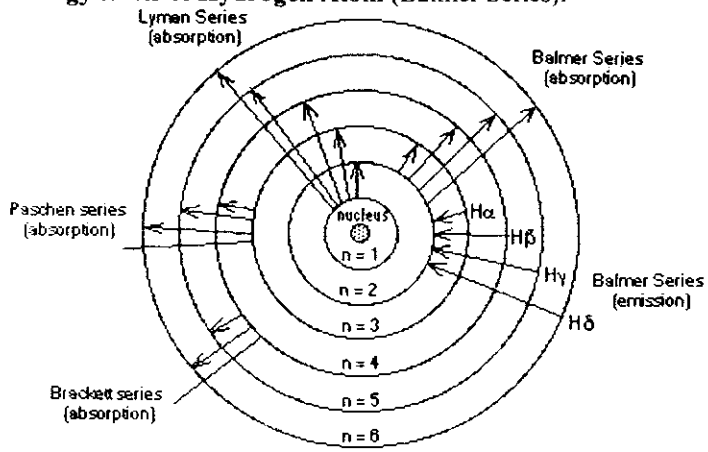
Energy levels of Hydrogen Atom (Balmer Series).



$$\Delta E = hf = 13.6\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right] eV$$

$1eV = 1.6\times10^{-19}$ Joules

$\lambda = \frac{c}{f}$ $\quad c = 3\times10^{8}$ m/s

$h = 6.6\times10^{-34}$ J·s

Obj: Determine photon energy and quantum number of electrons returning to n = 2
Balmer Series is visible.
Materials: H_2 gas tube, spectrometer
Methods & Analysis
1. Estimate the wavelength of red, blue, & violet bright lines to the nearest 10 nm.
Note: 5000 Angs. = 500 nm and 1 nm = 1 X 10^{-9} m
2. Calculate the energy of the emitted photon for each color in J and eV.
3. Find the difference in Energy.
4. Determine the quantum number from your reference table.
5. Which color has the highest energy? shortest wavelenght?

From the previous calculations, it can be stated that the only visible photons coming from hydrogen must include only, the red, blue greeen, purple and violet photons. All other jumps to any other levels and from any other levels will produce photons in the ultraviolet and infrared regions.

$E = hf$

Therefore, in order to find the value for Planck's constant using this data, you must follow the following rocedure:

1. Determine the allowable energies that can be observed from the hydrogen gas emissions and convert these values to Joules; there are only four visible photons in hydrogen; use these photons, only
2. Record the appropriate values for each line in hydrogen's visible spectrum using the data from the previous observed spectral lines. Use the frequencies obtained before.
3. Finally, calculate Planck's constant for the given lines.

LINE	COLOR	ENERGY (ev)	ENERGY (J)	FREQUENCY	PLANCK'S
1					
2					
3					
4					

* USING GRAPHICAL ANALYSIS, PLOT E vs f AND DETERMINE PLANCK'S CONSTANT - HINT h = SLOPE

average Planck's _____

RELATED QUESTIONS

1. Explain the process by which photons are produced by the hydrogen atom or any other atom.
(Hint: Bohr's theory might be applied)

2. CALCULATE PERCENT ERROR

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Introduction
http://cfa-www.harvard.edu/seuforum/galSpeed/

Using the mini-spectroscope applet found at http://mowww.harvard.edu/Java/MiniSpectroscopy.html, explore the emission spectra of hydrogen, galaxies, and some self created spectra. Calculate the Doppler shift for 3 galaxies.

Data and Analysis
Compare the fluorescent spectra to the lamps in this room
Prominent spectra lines online-
Prominent spectra lines room-

Compare the fluorescent spectra to the incandescent lamps
Prominent spectra lines fluor-
Prominent spectra lines incand-

Hydrogen emissions
Might want to review
http://hyperphysics.phy-astr.gsu.edu/hbase/hyde.html
Compare the values you measure with those in your textbook (page 843).
Electron transition Textbook (nm) Mini-spect online
6-2
5-2
4-2
3-2

2. Doppler shifts
Change in wavelength / wavelength of source at rest = speed of galaxy/ speed of light

	Red Wavelength	**velocity (m/s)**	**red or blue shifted?**
Galaxy 1			
Galaxy 2			
Galaxy 3			