Period 1 Student data sheet

Continuous Spectrum

Incandescent light spectrum	
Incandescent light description	

Bright Line Spectra

Gas Tube	Red	Orange	Yellow	Green	Blue	Violet
helium						
hydrogen						
mercury						
neon						
lithium						

Period 2 student data sheet

Qualitative observations: Draw the line spectra you saw

Data Table

Source and Color of Line	a (cm)	b (cm)	d (cm)	Wavelength (cm)	Wavelength (nm)	Frequency (s^{-1})	Energy (J/photon)	Energy (kJ/mole)	Rydberg Eq calculation of λ (nm)
1. H (red) $n = 3 \rightarrow n = 2$									
2. H (blue) $n = 4 \rightarrow n = 2$									
3. H (violet) $n = 5 \rightarrow n = 2$									

Work for calculations

1. Diffraction grating to cm

2. Wavelength calculation $\lambda = d\sin\Theta$
   a. $b/a = \tan\theta$

   b. $\tan^{-1}(b/a) = \theta$

   c. compute $\sin\theta$ using the sine trigonometric function on your calculator

   d. $\lambda = d\sin\Theta$

3. Calculate frequency using $c = \lambda\nu$

4. Calculate energy $E = h\nu$

5. Predict wavelength for various energy changes using the Rydberg equation $1/\lambda = 109678 cm^{-1}[1/n_f^2 - 1/n_i^2]$

Period 3 Student Data Sheet

Metal Ion	Red	Orange	Yellow	Green	Blue	Violet
Barium						
Calcium						
Lithium						
Sodium						
Strontium						
Unknown						

Post Lab Questions

1. Which emission line had the longest wavelength?_____

2. Which emission line has the highest energy photons?_____

3. Which type of mathematical relationship exists between frequency and wavelength?_____

4. Both He^+ and Li^{2+} are "hydrogen like" ions in that they only have one electron. These ions will also produce a line spectrum that obeys the Balmer-Rydberg equation but with different constants (R_{He} and R_{Li})

   a. In He^+ spectrum, a line appearing at 164.1nm corresponds to the red emission you observe for H. Use this information for calculate R_{He} for helium ion. Show work and record value in table below

b. Repeat the calculation for the Li^{2+} ion spectrum where a line appearing at 72.9nm corresponds to the red emission you observed for H. Record the value for R$_{Li}$ in the table below

Constant	R (for hydrogen atom)	R$_{He}$(Helium Ion)	R$_{Li}$(Lithium Ion)
R Value	0.01097nm^{-1}		
Integer	1		

5. You should find that the constants R$_{He}$ and R$_{Li}$ are interger multiples of R. Show the values of the these integer in the table above. The integers of all three are related to the atomic structure of specific atoms (H, He, and Li) How do the intergers relate to the atomic structure of H, He, and Li?