Name: _____ **Date** _____ **Section** _____

Lab Partner: ___ONLINE_____

Data Sheet: Atomic Spectra

Part A: Line spectrum of hydrogen gas

Using Rydberg's equation calculate the wavelength of the radiation emitted by a hydrogen atom for the following electronic transitions:

a. Calculate the frequency ν using the Rydberg Equation:

$\nu = R[(1 / n_1^2) - (1 / n_2^2)]$

$R = 3.29 \times 10^{15}$ Hz $1\ Hz = s^{-1} = 1/s$

b. Calculate the wavelength, λ, using $\lambda = c / \nu$ where c is the speed of light and $c = 2.99 \times 10^8$ m/s.

Transition between the levels	Wavelength of the emitted radiation (nm)
$n_2 = 3$ and $n_1=2$	
$n_2 = 4$ and $n_1=2$	
$n_2 = 5$ and $n_1=2$	
$n_2 = 2$ and $n_1=1$	
$n_2 = 3$ and $n_1 = 1$	

Observed lines from the spectroscope:

Observed Value	**Represented transitions**
660	n_2= _____ and n_1 =_____
485	n_2= _____ and n_1 =_____
428	n_2= _____ and n_1 =_____

Do these transitions belong to Balmer series or Lyman series: _____

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Part B: Line emission of gases using STAR Spectrophotometer –

1. Lines were observed at the following wavelengths. Looking at the spectrum on page 62 of your green book, determine the color that corresponds to each wavelength.
2. Go to the website listed below and look up the literature (theoretical) values which correspond to each observed line for the noble gases. Be sure to select "**nm**" for your units. Then scroll down the list. Choose the values closest to your observed values. For example, He has lines at 656 and 663; 663 is closer to 660, so you would record 663 as your literature value,

http://physics.nist.gov/PhysRefData/ASD/lines_form.html

Visible lines for **Fluorescent**			Visible lines for **Helium**	
Observed	Observed		Observed	Literature values
λ(nm) color	λ(nm) color		λ(nm) color	λ(nm) color
670 _____	603 _____		660 _____	_____ _____
650 _____	600 _____		590 _____	_____ _____
640 _____	580 _____		510 _____	_____ _____
630 _____	575 _____		500 _____	_____ _____
620 _____	520 _____		475 _____	_____ _____
615 _____	515 _____		450 _____	_____ _____
610 _____	505 _____		400 _____	_____ _____
605 _____				

Visible lines for **Argon**			Visible lines for **Neon**	
Observed	Literature values		Observed	Literature values
λ(nm) color	λ(nm) color		λ(nm) color	λ(nm) color
620 _____	_____ _____		650 _____	_____ _____
540 _____	_____ _____		600 _____	_____ _____
480 _____	_____ _____		590 _____	_____ _____
440 _____	_____ _____		550 _____	_____ _____
425 _____	_____ _____		500 _____	_____ _____
410 _____	_____ _____		430 _____	_____ _____

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Part C: Flame Tests –

1. **The Beilstein Test:** Use your copper wire to determine the flame color for the CH_2C1_2. Record the color of the flame. (Review the Atomic Spectra Powerpoint to determine the flame color for the Beilstein reaction: http://web.mst.edu/~tbone/Subjects/TBone/Atomic_spectra.ppt.htm)

2. **Flame Tests for Known Compounds:** Use the nichrome wire in the solution to determine the flame color of the other known compounds. Record the color. (Review the 13 Test Tubes Powerpoint page 11 to determine the flame color for inorganic compounds: http://web.mst.edu/~tbone/Subjects/TBone/13tt.ppt.htm)

Known compounds	Observed flame color
CH_2C1_2	
$CuCl_2$	
$FeCl_2$	
LiCl	
KCl	
NaCl	
$SrCl_2$	

3. **Flame Test for Unknown Compounds:** Based on your observations of the known compounds, determine the identity of the 6 unknown compounds. **Unknowns:** Li_2SO_4, Na_2SO_4, K_2SO_4, $FeSO_4$, &. $CuSO_4$. (*Unknowns need to be checked out from the stockroom. You may do these flame tests at your desk with your own Bunsen burner. Discard the unknowns in the proper waste container. Rinse the test tubes. Return the test tube, rack and wires to the stockroom.*)

Record Color of Unknown: ___**Online = Purple**_____

Observed flame color	Compound
1. Gold / Orange	
2. Green	
3. Yellow	
4. Purple	
5. Red	

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Atomic Spectra Post Lab Questions

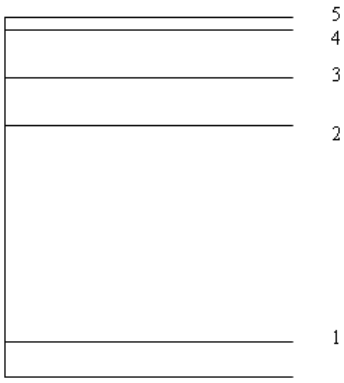
1. Why does the Hydrogen spectrum have the fewest lines? (*Compared to other elements*.)

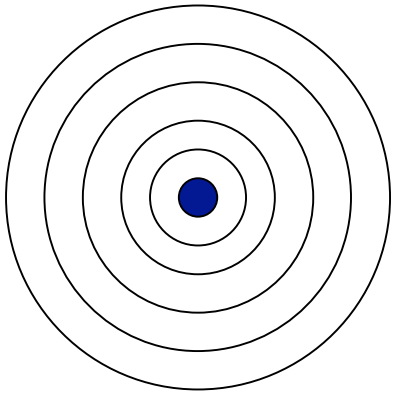
2. For the Hydrogen spectrum, why is the red line more intense (brighter) than the other lines?

3. If a flame test was performed on a strontium sulfate ($SrSO_4$) solution, what color do you think the flame would be?

4. The ferrous chloride solution was prepared using HCl and the ferrous sulfate solution was prepared using H_2SO_4. What effect would this have on your flame tests? Explain.

5. On the Energy Diagram and the Bohr's atom provided a.) label the energy levels; b.) draw the transition arrows and label them and for the Hydrogen gas transitions (p 65); and then, c.) show how the transitions correspond to the observed spectral lines for the Balmer series.





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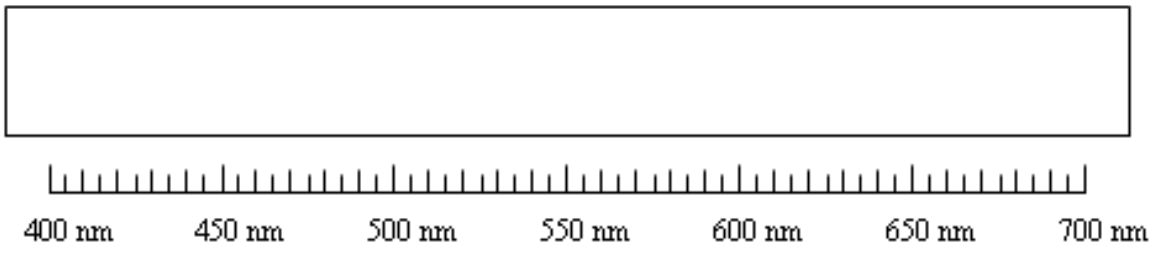
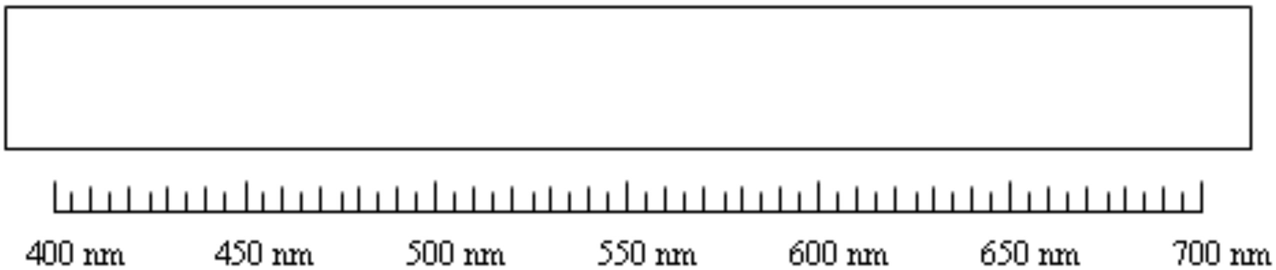


6. Below, draw emission spectra corresponding to the spectral lines for the observed data on page 66. (*Don't forget to indicate which element corresponds to which emission spectrum*.) Label the emission spectra with the color of the wavelength or use the appropriate color when drawing the spectral lines.

Emission Source:



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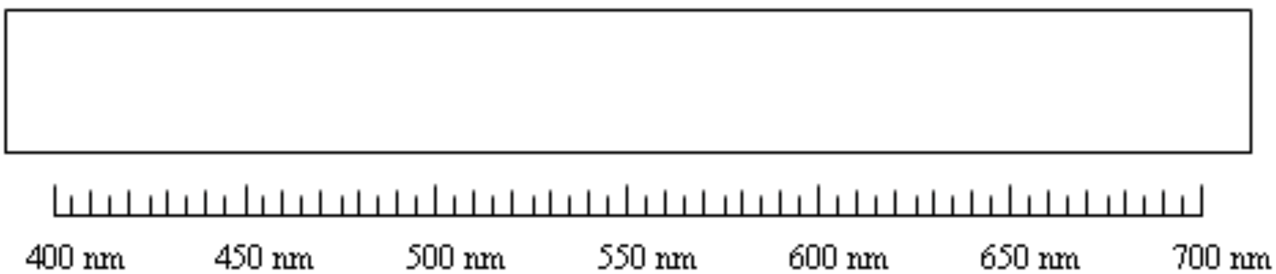

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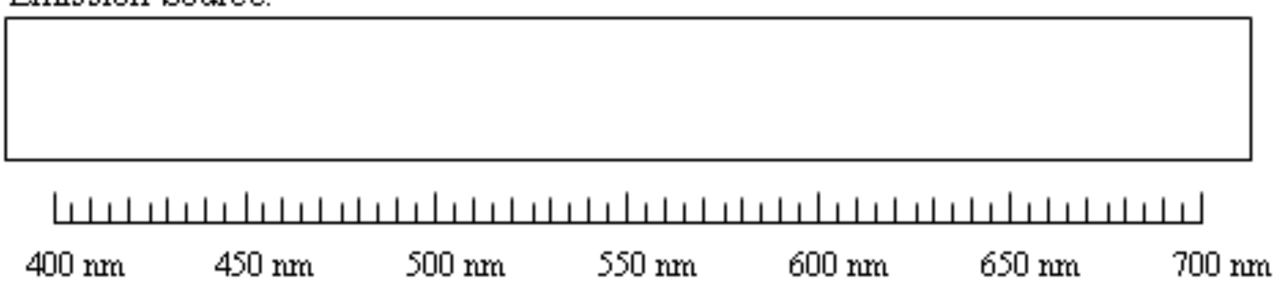

Emission Source: