Beer's Law Simulation: Extra Credit Lab

You just need to submit the data/results and conclusion section. This should be placed in your lab folder, titled: EC Lab: Beer's Law

Purpose:

- Investigate the relation between solution concentration and the intensity of light that is absorbed/transmitted;
- Investigate the relation among wavelength, solution color, and absorbance
- Learn the principles of absorbance and transmittance as investigative tools.

Background:

Go to http://teaching.shu.ac.uk/hwb/chemistry/tutorials/molspec/beers1.htm to find basic information about Beer's law.

Procedure:

Go to https://phet.colorado.edu/sims/html/beers-law-lab/latest/beers-law-lab_en.html and explore the simulation to see how it works.

Part 1: Concentration and Absorbance (Transmittance) and

1. Measure the Absorbance and Transmittance for different concentrations of three different solutions on the preset wavelength setting. Record the settings – notice that the settings are not the same for the different solutions.
2. Record your results in data table 1 and create two graphs (scatterplot) for the $CuSO_4$ data only with trendlines – concentration vs absorbance and Absorbance (x) vs transmittance.

Part 2: Pathlength and Absorbance

1. Measure the Absorbance at different pathlengths for three different solutions. Use the preset wavelengths and the same concentration for each solution. Use the cm ruler to measure the pathlength – you can move it to measure.
2. Make a graph depicting the absorbance (at what wavelength) (y-axis) vs path length (x-axis) for the $CuSO_4$ solution only

Part 3: Wavelength and Absorbance

1. Choose $CuSO_4$ as the solution
2. Use the same pathlength and concentration for all trials
3. Determine Absorbance at the preset and at variable wavelengths according to Table 3.
4. Record your results in a data table and Graph (scatterplot). Connect data with a line (not a trendline, but connect all points)

Data and Results:

Table 1: Concentration, Absorbance (A), and Transmittance (T) for Selected Solutions						
Concentration (mM or uM)	$CuSO_4$		$CoCl_2$		$NiCl_2$	
	nm =		nm =		nm =	
	A	T	A	T	A	T
25						
50						
75						
100						
125						
150						
175						
200						

Graph 1: Absorbance vs Transmittance for CuSO4

Graph 2: Absorbance vs Concentration for CuSO4

Table 2: Pathlength and Absorbance for Selected Solutions at ____ mM or uM			
Pathlength (cm)	$CuSO_4$	$CoCl_2$	$NiCl_2$
	nm =	nm =	nm =
	A	A	A
0.50			
0.75			
1.00			
1.25			
1.50			
1.75			
2.00			

Graph 3: Absorbance vs Pathlength for CuSO4

Table 3: Wavelength and Absorbance for Selected Solutions at pathlength = 1.00	
Wavelength (nm)	$CuSO_4$
	Conc. (mM) =
	A
380	
430	
480	
530	
580	
630	
730	
780	

Graph 4: Absorbance vs wavelength for CuSO4

Conclusion: 3 Paragraphs

- Explain how spectrophotometry works. Explain transmittance and absorbance, and use your results from table 1 to explain this relationship.
- State Beer's Law and explain the relation among absorbance, molar absorptivity, pathlength, and concentration. Use your results from table 1 to discuss to relationship between absorbance and concentration. Use your results from table two to discuss the relationship between absorbance and pathlight.
- Explain what a lambda max value is. State the relation among beam color, solution color (complementary), and maximum absorbance

Grading:

- **1 point per Data Table (3 points total)**
- **2 points per graph (8 points total)**
- **3 points per conclusion paragraph (9 points total)**
- **20 Points Possible**