**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Student Activity- Beer's Law**

**Learning Objective SAP-8.C** Explain the amount of light absorbed by a solution of molecules

 or ions in relationship to the concentration, path length, and molar absorptivity.

**Science Practices: 2.D** Make observations or collect data from representations of laboratory

 setups or results, while attending to precision where appropriate.

 **3.A** Represent chemical phenomena using appropriate graphing techniques,

 including correct scale and units.

 **5.F** Calculate, estimate, or predict an unknown quantity from known

 quantities by selecting and following a logical computational pathway

 and attending to precision.

**QUESTION:** How do we determine concentration of solutions through light absorbtion?

Instructions: You will be working with a computer simulation that uses Beer's Law.

Web Site address for the computer simulation:

<http://phet.colorado.edu/en/simulation/beers-law-lab>

1. To start the animation click on the **PLAY ICON** 

2. Click on the box labeled **Concentration**.

3. Move the circular concentration detector (the one with the cross hairs) to the middle of the water in the container.

4. Shake the drink mix container so that the concentration of your solution becomes

somewhere between 0.400 and 0.600 M. (If you put in too much powder, click the **RESET ICON** buttonon the bottom right side of the page to start again).

What happens to the color of your solution as the concentration was increased?

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5. On the bottom of the screen, Click the  **Beer's Law** tab.

6. Click the **Red button** on the wavelength control device.

7. Record your Concentration (bottom of the screen) \_\_\_\_\_\_\_\_\_mM

7. Record your % transmittance (top of the screen) \_\_\_\_\_\_\_\_\_% transmittance

8. Click the **Absorbance** button at the top of the screen to change the reading to Absorbance.

9. Record your absorbance. (no units) \_\_\_\_\_\_\_\_\_ = Absorbance

10. Now click the **Variable Button** on the wavelength control device.

11. Adjust your wavelength up and down. Observe what happens to the color of light emitted and your absorbance reading. What wavelength gave you the maximum absorbance and why?

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12. Now click the **preset** button on the wavelength control device.

13. Move the concentration lever bar at the bottom of your screen to the mM readings listed

below and record your absorbances.

**Conc. (mM)** **Absorbance**

 0 \_\_\_\_\_\_\_\_\_\_

 26 \_\_\_\_\_\_\_\_\_\_

 50 \_\_\_\_\_\_\_\_\_\_

 76 \_\_\_\_\_\_\_\_\_\_

100 \_\_\_\_\_\_\_\_\_\_

14. Use the graph on the next page to plot your points. Draw a best fit line to connect your points. Then using your graph, determine what concentration of solution you would have if the absorbance was 0.30.

 **Concentration of Colored Dye vs. Absorbance**

.60

.50

.40

.30

.20

.10

 0

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| **A****B****S****O****R****B****A****N****C****E** |  |  |  |  |  |  |  |  |  |
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 10 20 30 40 50 60 70 80 90 **Concentration (mM)**

Concentration of dye at absorbance of 0.30 \_\_\_\_\_mM