Solutions Investigation – Beer's Law **Name** _____

"Moles, Mass, and Molarity" **Block #** _____

Chocolate milk is an example of a solution in which a ***solute*** (chocolate syrup) is dissolved in a ***solvent*** (milk). If you like a lot of chocolate syrup in your milk, then you prefer ***concentrated*** chocolate milk. If you prefer only a little bit of chocolate syrup in your milk, then you like ***dilute*** chocolate milk. How can we relate this idea to chemistry? We would not use terms such as "dilute" and "concentrated" to describe chocolate milk. We'd probably say we like it chocolatey or not too chocolatey. When we are dealing with matter that is really small, we need to describe quantities with different terms. In this lab you will see how the mole can be used to describe solution concentrations.

For example, the molarity, *M*, of a solution is the number of moles of solute in one liter of solution. To determine the molarity of a solution, the following equation can be used:

$$\boldsymbol{Molarity = \frac{moles\ of\ solute}{liters\ of\ solution}} \qquad \boldsymbol{Liters \times Molarity \times Molar\ Mass = Grams}$$

In conjunction with the molecular mass of a solute, this equon is used to determine the number of grams of solute needed to prepare a given volume of a solution with a specific concentration.

Investigation Part 1: View the video, taking notes on the essential terms and concepts.

https://drive.google.com/file/d/1Yd39jT4ug0ljSddINAb9S5daqi61sjHl/view

Investigation Part 2: Use the simulation to explore solution concentration.

1. Go to https://phet.colorado.edu/sims/html/beers-law-lab/latest/beers-law-lab_en.html
2. Select Concentration. 

3. Choose the type of Solute. 

4. Shake the salt shaker to add solute to the water. 

5. Drag the concentration probe  into the solution to record the Molarity.

Data Collection:

1. Choose sodium chloride from the drop down menu at the top right. Move the drink mix  container up and down with your track pad to 'shake' some sodium chloride into the water.
2. Drag the concentration probe  onto the water to read the concentration of the solution.
3. Record the volume in Liters and the concentration in Molarity in the data table.
4. Use a periodic table to calculate and record the molar mass. (Molar mass = sum of all atomic masses. Example = NaCl is 23 g/mol for sodium and 35 g/mol for Cl so together the molar mass is 58 g/mol)
5. Calculate the number of grams of sodium chloride in the solution. (Grams = Liters x Molarity x Molar Mass)
6. Change the solid to copper(II) sulfate in the drop down menu.
7. Repeat steps 3-5 for copper(II) sulfate and 3 other solids of your choice.
8. Choose one of the solids that produced a colored solution.
9. Adjust the volume of the solution. What happens to the color of the solution when this adjustment is made? _____

Solid	Color of solution after solid is added	Number of 'shakes' of container	Volume of solution	Reported Molarity	Molar Mass of Solid Compound	Calculated mass of solute Liters x Molarity x Molar Mass = Grams
NaCl	**colorless**	**1**	**0.5 L**	**0.180 M**	Na = 23g/mol + Cl = 35 g/mol **58 g/mol**	**0.5 L x 0.180 M x 58 g/mol =** **5.22 g NaCl**
$CuSO_4$						