LAB: YOU ARE MY DENSITY

Name _____

Period _____

Question: Is there a relationship between concentration and density?

Background: In this experiment, we will first see if a relationship can be developed between concentration and density for sugar solutions. Then we will use a concentration curve to identify the concentration of some unknowns.

Four sugar solutions, along with some unknowns have been prepared for you. Solutions that are known concentrations are called **standard solutions**. The solutions provided are 0% (plain water), 5%, 10%, and 20% sugar by mass.

Density is a physical property of matter. To determine the density of a liquid, we need two pieces of information from a sample of the liquid: the mass and the volume. From these, the density can simply calculated as: Density = mass (in grams) / volume (in milliliters)

To measure volume, we will use a volumetric flask**.** This is a very precise piece of glassware that allows a volume of liquid to be measure much more accurately than is possible with a graduated cylinder. A volumetric flask, unlike a graduated cylinder, is very accurately marked at only ONE volume.

To measure mass, we will use an electric pan balance.

P**rocedure:**

1. Start with a CLEAN, DRY volumetric flask. Hold it only with a LABORATORY WIPE during the experiment so you do not transfer any oil from your hands to the flask – which could throw off the mass. **Use the same flask for all procedures.**
2. Determine the initial mass of the flask on a lab balance and record this in the data table.
3. Fill the flask with the 0% sugar solution so that the bottom of the meniscus is exactly on the mark on the neck of the flask. Adjust the volume using a dropper. **Make sure** there are is no liquid on the **outside** of the flask or drops on the **inside** above the mark.
4. Determine the mass of the **filled** flask. Make sure the balance is again tared to 0.00 before putting the filled flask on the balance.
5. Calculate the density. The volume is obviously the volume of the flask, but be careful when you use the mass. You only want the mass of the liquid, not the liquid and the flask together!
6. Repeat steps 3-5 with the 5%, 10%, 15%, and 20% solutions, recording the proper data for each solution.
7. Fill in the data table.

Data Table:

Mass of the empty volumetric flask: _____ g

NOTE: Round off your densities to THREE digits after the decimal place.

SUGAR SOLUTION DATA

% SUGAR SOLUTION	MASS OF FLASK ALONE (g)	MASS OF FLASK + SUGAR SOLUTION (g)	MASS OF SUGAR SOLUTION (g)	VOLUME OF SOLUTION (ml)	DENSITY (g/ml)
0.00%					
5.00%					
10.00%					
15.00%					
20.00%					

Calculations: We will use a graph to plot our data. Obtain graph paper from your teacher. On the x-axis (independent variable) write **% sugar solution**. On the y-axis (dependent variable) write **density of solution**.

Plot your data on the graph and connect the points using a **straight line of best fit**. Note: we are NOT "connecting the dots" but rather finding a single line that best reflects the slope of our data points.

Obtain a sample of one of the three unknowns. Determine the density using the method in the procedure. Now use your calibration curve to predict the sugar concentration from the density.

Repeat for the other unknown and Sprite solution.

UNKNOWN SOLUTION DATA

SAMPLE	MASS OF FLASK ALONE (g)	MASS OF FLASK + SUGAR SOLUTION (g)	MASS OF SUGAR SOLUTION (g)	VOLUME OF SOLUTION (ml)	DENSITY (g/ml)
Unknown A					
Unknown B					
Sprite					

EXTRA EXPERIMENTATION: Repeat the same procedures using a **graduated cylinder** and a **beaker**. Make a separate data table for each and plot the data on the graph using different colors to represent the different types of measuring tools.

Conclusions:

1. Define the terms **interpolate** & **extrapolate.**

2. What kind of "curve" is produced when plotting the % solution & density?

3. From the calculated densities and your graph, predict the % solution of sugar in Unknown A, Unknown B, and the Sprite.

   A:

   B:

   Coke:

4. From the information on the bottle, what is the % solution of sugar in a bottle of Sprite? (g sugar/ml solution)

5. Using the known value of solutions given by your teacher and your calculations from #4, find your **% error** for the volumetric flask, the graduated cylinder, and the beaker. (your answer – "book" answer / "book" answer) X 100%

   % error – volumetric flask:

   % error – graduated cylinder:

   % error – beaker:

6. Which of the three measuring tools was the most accurate in determining the % solution in a bottle of Sprite?