Grape Expectations

Market research conducted by Polar Beverages of Worcester, Massachusetts has revealed that consumers are highly interested in a new beverage, Grape Float. This refreshing and fictitious sweet drink will feature an actual grape suspended in the liquid. These consumers are somewhat calorie conscience but don't want artificial sweeteners.

We know that density is the basic problem faced by the food scientists at Polar. The scientists must simply float the grapes in the middle of the solution based upon the solution they create which must be homogeneous except for the grape.

In this experiment you will calculate the density of the grape after you float it in a sugar water solution.
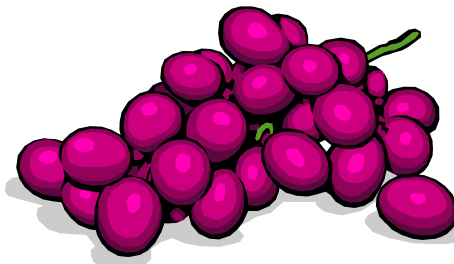
Purpose: In your own words, state what the purpose of the lab in the space below (i.e. What question are you answering).

Observations:

Hypothesis:

Materials
- 100mL graduated cylinders (3)
- Grapes
- Sugar
- Water (preferably distilled)
- Parafilm

Procedure
1. Put 60 mL of distilled water in a graduated cylinder.
2. Put the grape into the water. What happens?
3. Add a **known VOLUME** (Watch out it is not too much) of sugar to the graduated cylinder, shake it gently. What happened?
4. Continue to add small amounts of a known volume of sugar to the graduated cylinder, shake it gently after each addition, until the grape is suspended in the middle of the cylinder. Add more water if you find the grape is suspended too high due to too much sugar. Note the new volume of water!!
5. Calculate the **MASS** of the water. Water has a density of 0.997 g/mL at room temperature (25°C) and 1 atm (standard pressure). Sugar has a density of 1.59 g/mL under the same conditions. Remember $D = \dfrac{m}{V}$.

6. Calculate the percent of water and the percent of sugar in your solution. Remember the two percentages must add up to 100 percent.

$$\% \text{ sugar} = \frac{\text{mass of sugar (g)}}{\text{total mass of solution (g)}} \times 100 \qquad \% \text{ water} = \frac{\text{mass of water (g)}}{\text{total mass of solution (g)}} \times 100$$

7. Calculate the density of the grape: If the grape is made of sugar and water (It Is!) and the water is a sugar water solution AND your grape is suspended in the solution the calculating the density of the solution will give you the density of the grape!

$$D = (\% \text{ sugar})(D_{sugar}) + (\% \text{ water})(D_{water})$$

8. Show clear calculations with **UNITS**!!!!
9. Do a percent error calculation. Use the standard of 1.25 g/mL as the density of the grape.

$$\text{error} = \frac{|\text{your result - accepted value}|}{\text{accepted value}} \times 100$$

Questions:
1. Why would your results differ from the standard?
2. Do different types of grapes have the same density? Do some research and explain.