How Sweet It Is

Density is the ratio between mass and volume of a substance. Density is an intensive property, meaning that its value will remain unchanged as the amount of substance changes. The ratio of densities is an important tool in determining the composition of matter in chemistry.

Essential Question
How can the ratio of densities be used to determine the composition of matter?

ENGAGE
Density of a solution depends on its concentration. Concentration can be defined as how much solute is dissolved in a solvent. Gold alloys (solutions of gold, copper, zinc, platinum, and silver) are commonly found in jewelry. The amount of gold is represented in the units of karats in the table below.

Karats	Percent Gold	Density (g/cm^3)
24	99.9	19.3
18	75.0	16.5
14	58.3	14.0

1. Use the data above; construct a graph illustrating the relationship between density and the percent gold in an alloy.

2. What is the density percent gold in a 10 karat gold piece (41.7% gold)?

EXPLORE
Materials
    Top loading balance   Water
    10 or 20 mL syringe   3 sample beverages
    Sugar solutions (5%, 10%, 15%, and 20%)

Many beverages that we consume on a daily basis are solutions with very high sugar, or sucrose, content. Since the largest solute by far is sugar, the density of the drink or soda is comparable to pure sugar solutions. Experimental values will be compared with the information provided on the nutritional labels to evaluate the accuracy.

1. Based on your experiences and memory of taste, predict the sugar content of the beverages used in this laboratory activity ranking them from highest sugar content to lowest.

2. Using only the equipment and materials provided, design a procedure to measure the densities of various sugar solutions and use their densities to determine the sugar content of various beverages. Write your procedure in the space provided. Your procedure must include a data table for documentation of measurements and observations, and graphs. Have your teacher approve your procedure before actually performing any laboratory activity.

EXPLAIN
1. What sample beverages were used in the experiment?
2. List the density for each of the sample beverages?
3. What is the percent sugar in the sample beverages?

ELABORATE
1. From the labels of the beverages used in the laboratory activity, list the grams of sugar as found on the nutrition label and the volume of the beverage.
2. Using the value listed above and the density of the beverage, calculate the percent sugar in each unknown beverage.
3. Calculate the percent error for each unknown beverage.
4. List reasons for any percent error.
5. What effect do the other components of beverage have on the density? Explain.