Food Explorations Lab II:
Super Solutions

STUDENT LAB INVESTIGATIONS

Name: _____

Lab Overview

In this investigation, sugar will be dissolved to make two saturated solutions. One solution will be made using heated water, while the other will be made using cold water. The amount of sugar used in each solution and the amount of sugar in natural fruit juice will be compared.

Lab Objectives:

In this lab, you will learn how to…

1. Explain how temperature affects the amount of carbohydrate (sugar) in a solution.
2. Identify common sources of sugar in the human diet.
3. Identify the solute and solvent in a solution.
4. Calculate the calories in a food or drink due to its sugar content.
5. Identify foods and drinks with lower sugar content.

Lab Safety: Before beginning ANY investigation you should put on your safety goggles and apron. It is important to avoid getting chemicals on your hands. Always wash your hands following completion of an investigation. When handling food, you should also wash your hands prior to beginning an investigation.

Lab Questions

Which of the following solutions will contain the greatest concentration of sugar? (Circle your answer.)

Heated Sugar Solution Cold Sugar Solution Natural Fruit Juice

Predictions: I predict _____ will have the greatest concentration of sugar because…

Observation of Sugar Saturation

MATERIALS

100mL graduated cylinder
Beaker containing water
1 - 9 oz. plastic cup
1 small bag white sugar (25g)
1 plastic spoon
1 plastic knife
1 paper plate
1 medium bowl
1 hand juicer
1 triple beam balance
6 Styrofoam cups (1 per student)
4-5 oranges

PROCEDURE

Heated Solution

You teacher will demonstrate how to create a solution using heat.

1. On high heat, your teacher will quickly heat 100mL of water.
2. While the water heats, your teacher will measure out 250 grams of sugar.
3. Once the water is hot (simmering, but not boiling), your teacher will add 50-100 grams of sugar at a time. Your teacher will allow the sugar to dissolve before adding more sugar.
4. Your teacher will continue to add sugar until additional sugar will not dissolve. If your teacher has to add additional sugar beyond the initial 250 grams, he/she will measure and add sugar in 50-gram increments.
5. Record the amount of carbohydrate (sugar) your teacher needed to create a supersaturated heated solution in Table A under the column labeled “Heated Solution.”
6. Your teacher will divide the hot solution into separate Styrofoam cups (1 per group of students) and set aside. The heated solutions will cool for later observation.

Cold Solution

1. Measure 100mL of cold water and pour into the 9 oz. plastic cup.

2. Add the 25g of sugar a little at a time to the cup of water and mix until the sugar dissolves.

3.Continue to add sugar until it will no longer dissolve.

4. If you have to add additional sugar beyond the initial 25g, be sure to measure the gram amount of each new addition of sugar using the triple balance beam.

STEP 1: Place a clean Styrofoam cup on your balance. Mass the cup using the triple beam balance.

Mass of Empty Cup =	_____ **g**

STEP 2: Pour additional sugar into the cup. Mass the cup and sugar.

Mass of Cup and Sugar =	_____ **g**

STEP 3: Subtract the mass of the empty cup from the mass of the cup and sugar.

_____**g** – _____**g** =	_____ **g**
Mass of Cup and Sugar – Mass of Empty Cup =	**Mass of Additional Sugar**

5. If you used less than the provided 25g, measure any remaining sugar and subtract the mass from the original 25g.

STEP 1: Place a second clean Styrofoam cup on your balance. Mass the cup using the triple beam balance.

Mass of Empty Cup =	_____ **g**

STEP 2: Pour remaining sugar into the cup. Mass the cup and sugar.

Mass of Cup and Sugar =	_____ **g**

STEP 3: Subtract the mass of the empty cup from the mass of the cup and remaining sugar.

_____g – _____g = **Mass of Cup and Sugar – Mass of Empty Cup =**	_____ g **Mass of Remaining Sugar**

6. Record the amount of carbohydrate (sugar) used to make the cold solution in Table A under the column labeled "Cold Solution."

Fruit Juice Solution

1. Wash your hands.
2. Slice each orange in half. Over the medium bowl, use the hand juicer to remove the juice from each orange half.
3. Measure 100mL of fresh orange juice (no pulp) and pour into a cup.
4. You have made fresh orange juice! Repeat steps 2 and 3 with each orange putting the juice in the Styrofoam cups. Allow every group member to taste the orange juice.
5. Record the amount of carbohydrate present in the orange juice solution in Table A under the column labeled "Natural Fruit Juice Solution." On average, 1 orange contains about 9g of natural sugar (carbohydrate).

Table A:

Heated Solution (gram/mL)	Cold Solution (gram/mL)	Natural Fruit Juice Solution (gram/mL)
250g/100mL	25g/100mL	9g/100mL

Conclusion:

1. Order the solutions (heated, cold, or natural juice) from the most sugar content to the least. Explain how this compares to your original response to the lab question.

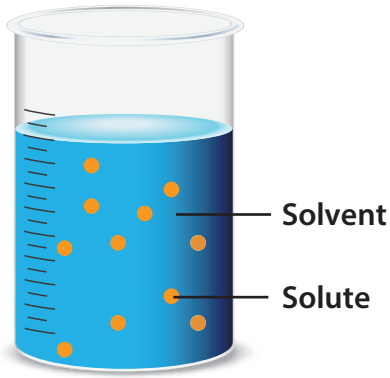
   The heated solution contained the most sugar and the natural solution contained the least.

2. Obtain a heated solution sample from your teacher. Compare and contrast the appearance of the heated solution to the cold solution.

   The heated solution is thicker and opaque; it contains more sugar particles. The cold solution is think and cloudy.

3. In a solution, the solvent is present in the greatest amount. The solute is dissolved within the solvent. Explain which component (water or sugar) is classified as the solvent and which is the solute. Use the diagram to help guide your answer.

   Water is the solvent and sugar is the solute.



4. Explain why there are differences in the solubility of sugar molecules when added to hot water versus cold water.

   Hot water molecules move more rapidly than cold water molecules, allowing the sugar to dissolve more easily.

5. Using you results in Table A, how many calories from carbohydrate would each solution provide per 100mL? There are 4 calories in 1g of carbohydrate.

   Heated Solution:

   250g x 4cal = 1000cal per 100mL

   Cold Solution:

   25g x 4cal = 100cal/100mL

   Natural Fruit Juice: ★

   9g x 4cal = 36cal/100ml orange juice

6. Circle the solution under question 5 that provided the most calories. Place a star by the solution that provided the least amount of calories.

   Students should circle the heated solution, indicating it provides the most calories and place a star by the natural fruit juice, indicating it provides the least amount of calories.

7. Provide an example of a saturated sugar solution that you drink on a regular basis.

   Any drink with added sugar like sports drinks, soda, and energy drinks.

8. Based on the reading "Sugar Solutions", what does your body do with the sugar you eat or drink when it is not needed for energy?

   The sugar is converted to fat for storage.

9. Considering the higher calorie content of sweetened beverages, name two alternatives you can drink.

   You can choose diet drinks, zero calorie alternatives, or water.