

How Sweet It Is!

A Colorful Sugar Solution Density Column

Introduction

Seven colored solutions of different densities are prepared, and then carefully added to a graduated cylinder to demonstrate layering. A vertical rainbow of colors is produced! A spectacular demonstration on density.

Concept

- Density

Materials

Sucrose (table sugar), approximately 300 g
 Water, distilled or deionized, approximately 1 L
 Balance, graduated cylinder, 7 beakers or cups, and stirring rods to use in preparing the seven solutions
 Food coloring (red, yellow, green and blue)
 Graduated cylinder, 1000-mL

Glass tubing
 Ring clamp
 Ring stand
 Rubber tubing
 Separatory funnel, 250-mL

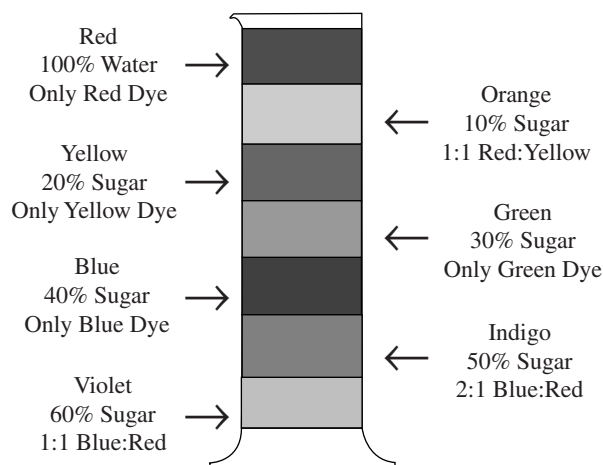


Figure 1.

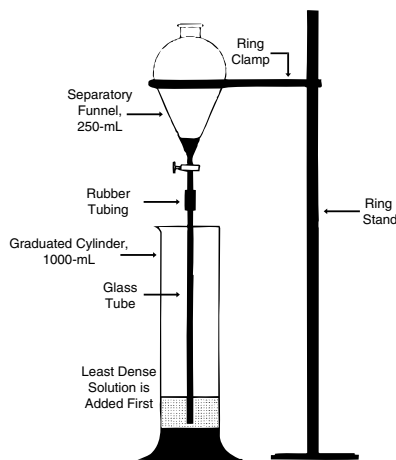


Figure 2.

Safety Precautions

Although this lab is considered nonhazardous, observe all laboratory safety procedures. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Preparation

Prepare seven equal volumes of sugar-water solutions from sucrose, water and food coloring according to the ratios indicated in Figure 1. *Note:* The red solution is 100% water and 0% sugar.

Procedure

1. Construct the apparatus according to Figure 2. Be sure to keep the glass tubing very near the bottom of the graduated cylinder during the addition of solution.
2. Add the red colored water to the separatory funnel. (Regardless of the colors selected, remember to add the least dense solution to the cylinder first!)
3. Partially open the stopcock valve and allow the red solution to slowly drain into the bottom of the graduated cylinder. Close the valve before all the red (least dense) solution drains from the separatory funnel. A continuous volume of solution must be present in the tubing during the entire column “construction.”
4. Now add the orange (second least dense) solution to the separatory funnel. Close the valve just before all of the orange solution drains from the separatory funnel. Add each remaining solution in a similar fashion.
5. Carefully withdraw the glass tube and observe your sugar rainbow.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Solutions may be rinsed down the drain.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

- Evidence, models, and explanation
- Constancy, change, and measurement

Content Standards: Grades 5–8

- Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

- Content Standard B: Physical Science, structure of atoms, structure and properties of matter, chemical reactions

Tips

- To almost fill a 1000-mL graduated cylinder, make 140 mL of each sugar-water solution

Final volume with water is 140 mL	
Red:	0% sugar = 0 g sugar
Orange:	10% sugar = 14 g sugar
Yellow:	20% sugar = 28 g sugar
Green:	30% sugar = 42 g sugar
Blue:	40% sugar = 56 g sugar
Indigo:	50% sugar = 70 g sugar
Violet:	60% sugar = 84 g sugar

- To save time making the sugar-water solutions, try using one sugar cube or packet for the least dense sugar solution, two packets for the next solution, etc. Add the solutions while students make observations.
- As a lab, challenge the students to prepare seven different layers using only sugar, water and food coloring!

Discussion

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

Since all the solutions have the same volume, the greater the amount of sugar in the solution, the greater the density.

Acknowledgments

Special thanks to John Hnatow, Jr., Emmaus High School, Emmaus, PA for providing us with the instructions for this activity.

Materials for *How Sweet It Is!* are available from Flinn Scientific, Inc.

Catalog No.	Description
S0134	Sucrose, 500 g
V0003	Food Coloring, set of 4
GP5060	Separatory Funnel, 250 g

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.