

## How Sweet It Is! Rainbow Density Column

### Purpose

To demonstrate how the density of an aqueous sugar solution changes with concentration.

### Materials

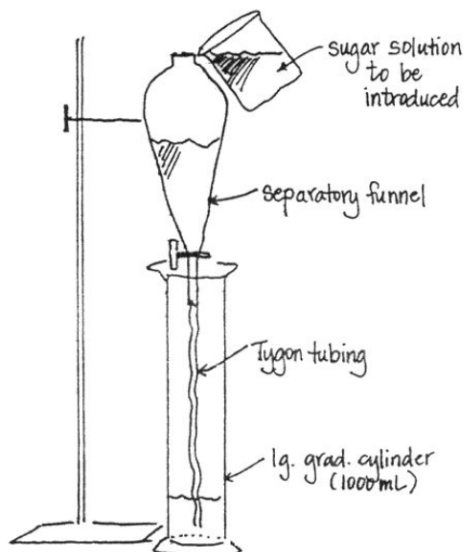
300 g sucrose	separatory funnel, 250 mL
food coloring	rubber tubing
balance	graduated cylinder
7 beakers or cups	1000 mL tall cylinder
stirring rods	500 mL graduated cylinder

### Procedure

1. Prepare seven solutions of sugar water according to the table given below. Make the colored water solutions first, adjusting the colors to the desired shade for clear distinction between them before adding the sugar. Measure 140 mL of water of each color into a beaker. Then dissolve the sugar in the colored water.

Color	Dye	Sugar Concentration	Sugar Mass
Red	Red	0%	0 g
Orange	Red:Yellow (1:1)	10%	14 g
Yellow	Yellow	20%	28 g
Green	Green	30%	42 g
Blue	Blue	40%	56 g

1. Set up the apparatus as shown in the diagram below. The rubber tubing must be very near the bottom of the 1000 mL cylinder during the addition of the solutions.



2. Add the red colored sugar solution to the separatory funnel with the stopcock closed.
3. Partially open the stopcock valve while angling the tubing upward in order to fill the tubing completely with red solution. Place the hose in the 1 L cylinder and close the valve on the separatory funnel just before all the red solution has drained from the separatory funnel. It is very important that the hose is completely filled or the solutions will not flow into the hydrometer as the other colors are added.
4. Now add the orange solution to the separatory funnel. Again, close the stopcock just before all the orange solution has drained from the separatory funnel.
5. Add each of the remaining solutions in order of increasing concentration in the same way.
6. Carefully withdraw the tubing and remove the separatory funnel from the column.

### Additional Information

1. The solutions can be prepared using a microwave to warm the water for sugar dissolution. This can be done the day before the demonstration. The solutions can be transported in foam cups with lids.
2. The addition of each solution should be made **slowly** so distinct layers can be seen.
3. The distinct layers are visible for at least 24 hours if the column remains undisturbed.
4. Students can construct their own columns in 10 mL graduated cylinders. Use Beral pipets and carefully add 1 mL increments progressing from the most dense solution (violet) to the least dense solution (red).

**Disposal**

Solutions should be poured down the drain with excess water.

**Reference**

ICE Chemistry Fundamentals Workshop, Mt. San Antonio College, 1993.

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