

## Inquiry Approaches

### Initial Inquiry

What do you think will happen if two solutions, one which contains more sugar than the other, are added to a container?

Initially, the different densities will cause the solution with more sugar to sink to the bottom and the solution with less sugar to rise to the top. Eventually, both solutions will mix together because they are miscible.

Why does ice float in a glass of water?

Ice is formed from frozen water, but is less dense than water because it contains some air. Ice is lighter than water, therefore it floats.

### Experimental Procedure Inquiry

Why do we need a straw to pour in the solutions?

The straw allows the solutions to be poured into the container without disturbing the different layers.

What colour do you think will be formed when red and blue food colouring are mixed together? What colour will be formed when red and yellow are mixed together?

Red and blue combine to form purple, and red and yellow combine to form orange.

Why do solutions with more sugar settle on the bottom?

The same volume of water is used to make all the sugar solutions, therefore solutions which contain more sugar will be more dense than solutions which contain less sugar. The denser solutions will stay at the bottom of the container. The layers of the rainbow are created by adding increasingly dense sugar solutions of different colours to the bottom of the glass.

Why did the red solution stay at the bottom of the container and the purple one stay at the top?

The red solution has the highest density because it contains more sugar than the purple solution. Thus, it remained at the bottom of the container. The purple solution was the least dense so it stayed at the top.

Why do the layers not mix?

Unlike density columns which are made using immiscible liquids such as oil and water, the miscible sugar and water solutions will eventually mix and achieve equilibrium, forming a single uniform solution. Fortunately, this equilibrium takes some time to establish (over 24 hours), allowing the use of miscible sugar solutions with different densities to form a layered rainbow effect.

Why are the solutions not added from most dense to least dense?

Pouring a solution of lower density on top of a solution of higher density is incredibly difficult when using miscible liquids, such as sugar and water solutions. The layers are considerably disturbed by the action of pouring and will mix together instead of forming distinct layers. A straw is used to add increasingly dense sugar solutions directly to the bottom of the container, without the disruption of other colours.



a WOW Lab

**BLUEPRINT**

## Rainbow in a Bottle - Inquiry Approaches

### **In-Depth Inquiry**

What would happen if you stirred the container with all of the separate layers?

The different layers would mix together because they are miscible and form a new solution with a single blended colour and uniform density.