On the Level

Density Demonstrations

Introduction

The liquid in the tube is unbalanced! How can this be possible? Amaze students with this simple liquid density demonstration.

Concepts

- Density
- Specific Gravity
- Observation

Materials

Food coloring, green
Sodium chloride solution, NaCl, saturated, 50 mL
Water, distilled or deionized
Beakers, 100-mL, 2
Clamp, double buret
Funnel, small (optional)
Stirring rods, 2
Stoppers, rubber, solid, size 00, 2
Support stand
Tubing, plastic, ½-inch, 2 feet

Safety Precautions

Although the materials in this lab are considered nonhazardous, follow all standard laboratory safety procedures. Wash hands thoroughly with soap and water before leaving the laboratory. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Clamp the double buret clamp onto the support stand.
2. Clamp the ½-inch plastic tubing into the double buret clamp to form a U shape (see Figure 1).
3. Add a few drops of green food coloring to 50 mL of DI water in a beaker. Mix well.
4. Add a few drops of green food coloring to 50 mL of saturated sodium chloride solution in the second beaker, matching the shade of green to that of the water.
5. Carefully and slowly pour the green saturated sodium chloride solution down one side of the tube.
6. Carefully and slowly pour the green DI water down the other side of the tube to minimize mixing of the liquids. Once the water is completely added, the liquid levels should not be equal (see Figure 1).
7. Stopper both sides of the tube.
8. Ask students to share their observations.

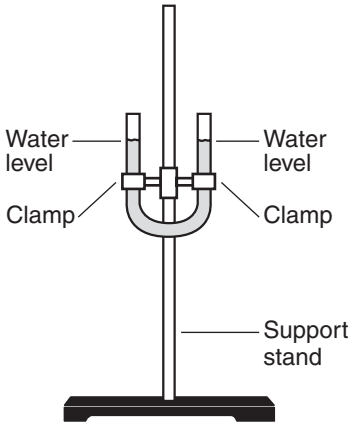

Figure 1.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Waste liquids may be disposed of according to Flinn Suggested Disposal Method #26b.

Tips

- Have the tube set up before students arrive, and ask them to help figure out why the levels are unequal.

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- If the tube is shaken up, the levels will even out.
- To make the interface between the two liquids easier to view, leave both liquids clear or use food coloring in only one of the liquids. (The food coloring will mix slightly with the clear liquid right around the interface.)
- The demonstration kit, Lopsided Liquid (Catalog No. AP6649), available from Flinn Scientific, uses a glass U-tube and isopropyl alcohol to demonstrate the same concepts.

Discussion

The U-shaped tube allows for free flow of a liquid, so it seems ironic that the heights of the liquid in each side should differ. The difference in height is due to the difference in the density of the liquids. *Density* is defined as the amount of matter that occupies a given unit of space; it can also be thought of as the "compactness" of a substance. Dense materials (such as lead or gold) are very heavy for their size whereas less dense substances (such as a big bag of feathers or a filled balloon) are light for their size.

Density is equal to a substance's mass per unit volume, where *mass* is the amount of matter in an object (measured in grams) and *volume* is the amount of space that an object occupies (measured in milliliters or cubic centimeters). The equation to calculate density is as follows:

$$\text{Density} = \frac{\text{Mass (g)}}{\text{Volume (mL)}}$$

Density is an intrinsic physical property of matter—that is, it is a property unique to a specific substance (at a specified temperature) no matter what size the sample. Density can therefore be used to distinguish one substance from another. The identity of an unknown substance can be determined by measuring its density in the lab. The experimental value for density can be compared to the density recorded in scientific literature and the substance can often be identified. A substance's density varies with temperature and pressure changes. The benchmark for comparing density is water, which, at 4 °C, has a density of 1.0000 g/mL. Substances that float in water are less dense than water, while substances that sink are more dense than water. Saturated sodium chloride is more dense than water. Therefore, the side of the U-tube with the lower level contains the solution with the greater density.

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
Evolution and equilibrium
Content Standards: Grades 5–8
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, properties and changes of properties in matter
Content Standards: Grades 9–12
Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter

Flinn Scientific—Teaching Chemistry eLearning Video Series

A video of the *On the Level* activity, presented by Mike Roadruck, is available in *Density Demonstrations*, *Discrepant Event—Physical Properties*, and *Properties of Liquids*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *On the Level* are available from Flinn Scientific, Inc.

Catalog No.	Description
AP6649	Lopsided Liquid—A Liquid Density Demonstration Kit
AP2261	Clamp, Double Buret
AP2307	Stopper, Rubber, Solid, Size 00
AP8226	Support Stand
AP8378	Tubing, Plastic, ½-inch, 10-feet

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