



Determination of Density

Topical Unit of Instruction: Properties of Matter

Introduction

Only one potentially toxic liquid is used in this lab and it happens to be a common household toxin. The chemicals can also be reused from class to class.

Time

50 minutes for data collection

Objectives

1. To determine density of three unknown liquids.
2. To practice correct use of volumetric pipet.
3. To generate "best fit" lines from plotted points.

Preparation

Liquid A

Liquid A is saturated salt water. About a week before the lab is scheduled, put about 200 mL of distilled H₂O in a large beaker. Add NaCl until a fair amount is sitting on the bottom of the beaker. Mix well. Continue to add NaCl and mix for several days as solution continues to dissolve more salt. On the morning of the lab, mix in a few drops of food coloring and pour the supernatant from the saturated saltwater into 3-4 dispensing containers that have been clearly labeled as "A". Accepted density is 1.2 g/mL.

Liquid B

Liquid B can be either methanol, ethanol, or isopropanol. If you choose isopropanol, purchase it from a chemical supplier. The isopropanol sold in drug stores as rubbing alcohol is actually a 70% solution in H₂O and will not give the appropriate results. Add a few drops of another food color to about 200 mL of the alcohol and dispense into 3-4 containers labeled as "B". Accepted density is 0.8 g/mL.

Liquid C

Liquid C needs no preparation. Dispense 200 mL of distilled H₂O between 3-4 containers labeled as "C". Accepted density is 1.0 g/mL.

Materials

(For a class of 32 students working in pairs)

- 16 small beakers (25 or 50 mL)
- 16 centigram balances
- 16 assorted pipets (including the following sizes: 0.5, 1, 2, 3, 4, 5, 7, 10, 15, and 25 mL)
- 16 pipet fillers
- 200 mL each of liquid A (saturated salt water), liquid B (methanol, ethanol, or isopropanol), and liquid C (distilled water)
- 32 sheets of graph paper



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Safety Reminders

1. Students should never taste any chemical, but emphasize that liquid B is particularly toxic.
2. Presenting the liquids as different colors eliminates the potential for students to pour the chemicals back into the wrong dispensing container and thereby contaminate a large quantity. Tell them that all of the liquids are actually colorless, that you have added the color for safety and that the color has no effect on the results of the lab.
3. Volumetric pipet tips are especially fragile. They can easily be chipped if students are not careful about shaking them dry. In addition to the chipped glass being a safety issue, the pipet will probably not deliver its appropriate volume.
4. Remind students to never mouth pipet.

Typical Results

When best fit lines are drawn from class data, the slopes of the lines are very close to the accepted densities.

Disposal

Liquids A and C can be poured down the drain. Liquid B could be saved for cleaning purposes (where very pure alcohol is not necessary) or allowed to evaporate over the course of several weeks.

Hints

1. Assign a pipet size to each pair of students to ensure a wide range of class data. Make sure students are comfortable using pipets before they start the data collection.
2. After students have completed their graphing, ask them if they can identify any of the liquids. They will often correctly identify liquid C as water. Tell them what the liquids are at this point.

