

Layering Liquids

You probably already know that a cork floats in water because it is less dense than water. You can use this principle to make a density column and to determine the relative densities of different objects.

Materials

- clear glass bud vase or other slender glass container
- tablespoon measure
- liquids:
 - vegetable oil
 - dark Karo® syrup
 - rubbing alcohol
 - Dawn® or other dishwashing liquid
 - water (addition of 1 or 2 drops of food coloring is optional)
- solids (as many as possible; must be small enough to fit in bud vase or other slender glass container):
 - ball bearing or BB
 - plastic bead
 - rubber stopper
 - cork
 - super ball
 - pine chip (part of a craft stick works)
 - any other solids you wish to test

Exploration

- Step 1 Place two tablespoons of one of the liquids listed above in the glass bud vase. Then add two tablespoons of one of the other liquids. What happens? How can you tell which one has the greater density?
- Step 2 Repeat this experiment several times using different liquids from the list. The densities of the liquids are: 0.87 g/mL, 0.91 g/mL, 1.00 g/mL, 1.26 g/mL, and 1.37 g/mL. Try to match up each density with its respective liquid based upon your results.
- Step 3 Now that you know the densities of each of the liquids, slowly pour two tablespoons of each of the liquids into the glass bud vase in order of decreasing density (the highest density liquid on the bottom) to create a density column. How does your density column look?
- Step 4 Drop each of the solids into the density column that you created in Step 3. What happens to each of the objects? Explain what the position of each object in the density column means. Can you tell what the density of each object is? Try other objects if you wish.

Challenge

What are the relative densities of various common liquids and solids?

Layering Liquids

Concept

relative density

Expected Student Responses to Exploration

Step 1 (a) Either the second liquid will float on top and there will be little or no mixing; or the second liquid will sink to the bottom, perhaps mixing some with the first as it passes through.

(b) Whichever has the greater density will be on the bottom.

Step 2 Liquid	Density (g/mL)
rubbing alcohol	0.87
vegetable oil	0.91
water	1.00
Dawn	1.26
Karo syrup	1.37

Step 3 The liquids form layers in the order in which they are placed in the bud vase, with relatively little mixing between them.

Step 4 (a) An object either floats on top of one of the liquid layers or sinks to the bottom.

(b) An object is less dense than the liquid it is floating on and more dense than the one it is in.

(c)

Solid	Location	Density(g/mL)*
ball bearing or BB	on bottom of the bud vase	ball bearing or BB >1.37
plastic bead	floating on the Dawn layer	1.26 > plastic bead >1.00
rubber stopper	floating on the Karo syrup layer	1.37 > rubber stopper >1.26
cork	floating on the alcohol layer	0.87 > cork
super ball	floating on the water layer	1.00 > super ball > 0.91
pine chip	floating on the vegetable oil layer	0.91 > pine chip > 0.87

*Relative densities may vary slightly depending on specific item used.

Expected Student Answer to Challenge

ball bearing or BB > Karo > rubber stopper > Dawn > plastic bead > water > super ball > vegetable oil > pine chip > rubbing alcohol > cork

Reference

“Household Density Column”; *Fun with Chemistry: A Guidebook of K–12 Activities*, 2nd ed.; Sarquis, M., Sarquis, J., Eds.; Institute for Chemical Education: Madison, WI, 1995; Vol. 1, pp. 115–118.

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