

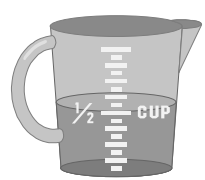


Density Layers

THE BASICS	THE TOOLBOX	EDUCATION STANDARDS	Physical Science Content Standard: Understanding the properties of solids and liquids, and the concepts of solubility and density.
 Grade Level: K-12	<ul style="list-style-type: none"> • Clear glass jar with lid • ½ cup light corn syrup • ½ cup water • Food coloring • ½ cup vegetable oil • Plastic cups • Paper towels • Crayons or markers • Various small solid objects (see below) 	SAFETY CONCERNS Be careful of spills and slippery floors. Clean up spills as soon as they happen. Make sure younger students do not put objects into their mouths.	
 Estimated Time: 40 min.		FOR KIDS WITH DISABILITIES Visually impaired students can hold cups with liquids to compare weights. Mobility-impaired participants may work with a partner or work with larger objects.	



Educational Objective:

To develop an understanding of the properties of liquids, and the concepts of solubility and density. To demonstrate that liquids can float on other liquids, and that solids may sink in some liquids and float in others.

Materials Preparation:

- Gather various small solid objects to drop into the liquid, such as toothpicks, wooden matches, thumb tacks, marbles, beans, seeds, grapes, raisins, or any other objects used in the *Sink or Swim* activity.
- A mayonnaise jar works well for this activity.
- You may want to try the activity ahead of time so that you can find at least one item to use that will float at each level.
- Make sure there is no soap residue in the jar. Any residue may emulsify the oil and water, causing a cloudy mixture that will not separate well.
- You may want to package the test items in a Ziploc bag.
- You may want to ask each student to bring in one thing from home.

What To Do:

- Give each group a measuring cup, a jar, the various liquids, and items to test. Depending on the age of the students, you may want to pre-measure the oil, water, and corn syrup for them.
- Start by measuring and pouring a ½ cup of water into the jar. From this point on, have students predict what they think will happen before they add each item to their jars. Next, add a few drops of food coloring and observe what happens.
- Continue having students add various items in the following order: oil, syrup, and various test items (one at a time).
- If you want, students may take jars home for observations over time. The three layers will stay for quite some time if the jar is not shaken very much. Eventually the corn syrup will dissolve in the water, and mold may start to grow in the sugary solution.

Questions to Ask Students As They Do This Activity:

- Can a liquid float on another liquid?
- Can a solid object float in one liquid, but sink in another liquid?
- What makes an object sink or float?
- Do the biggest objects always sink? Do the smallest objects always float?
- Would a bigger or smaller object made of the same material do the same thing?
- How close were your guesses? Why did you guess the way you did? Was your guess based on previous experience?

Why It Happens:

All liquids are not alike. When a liquid such as the food coloring dissolves in another liquid, the two liquids are said to be **miscible**. When two liquids such as oil and water do not mix, they are said to be **immiscible**.

Upon stirring or shaking, sometimes tiny droplets will form throughout the mixture. These are called emulsions, but when you stop stirring, the liquids will separate out and the oil will collect above the water. This is because the oil is lighter, or not as dense, as the water. Since the water molecules are heavier than oil, they all sink to the bottom. Syrup molecules are heavier than water and oil and should settle beneath the oil and water. After mixing all 4 liquids you should have 3 layers because of their difference in their densities, with the heaviest items on the bottom. (Note: Depending on how vigorous the jar is shaken, the water and corn syrup may mix temporarily creating 2 layers and a liquid that is more dense than water alone, but less dense than corn syrup.)

Each solid object will sink until it reaches a liquid that is denser than the object. Some of the solids are denser than all three liquids, and should sink to the bottom of the jar. Others may be suspended between layers, or may float on the top layer.

WEB SITES

- **The Weight of Water**
<http://www.seaworld.org/water/weight.html> (Grades K-3)
- **HyperChemistry on the Web**
<http://library.thinkquest.org/2690/> (Grades 3-12)

SOFTWARE

- **Learn About Physical Science: Matter, Measurement and Mixtures**
Sunburst
(Grades K-2)
- **Bumptz Science Carnival**
Theatrix/Sanctuary Woods, 1995.
(Grades 1-5)

READING ROOM

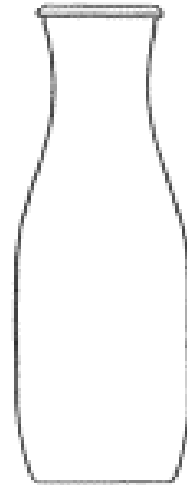
- Gardner, Robert. **Science Projects About Chemistry**. Enslow, 1994. (Grades 7 and up.)
- VanCleave, Janice. **Janice VanCleave's 201 Awesome, Magical, Bizarre, and Incredible Experiments**. Wiley, 1994. (Grades 1-8)

Career Connections

Food scientists require a lot of expertise in different areas of science. Not only must they be familiar with the chemical composition of foods, but they must understand the nutritional factors, the microbiology, pharmacology, and toxicology of food materials and additives.

DENSITY LAYERS ACTIVITY SHEET

1. In front of you are various liquids, and a collection of objects. Measure out a $\frac{1}{2}$ cup of each liquid and compare them. Pick up each object and look at it closely. Note similar and different characteristics between the objects.
2. Predict whether each of these liquids will mix with each other, and whether the solid items will sink to the bottom, float on top, or be somewhere in-between. Write down your predictions and draw a diagram of what you think your complete jar will look like and your reasons why.
3. Start by pouring the water into the jar. Next slowly add a few drops of food coloring and observe what happens. Swirl the jar slightly, then vigorously. Do the water and food coloring mix?
4. Slowly pour an equal amount of oil into the jar and observe what happens. Now, swirl the jar slightly, then vigorously. Do the oil and water mix?
5. Finally pour an equal amount of syrup into the bottle and observe what happens. Swirl the jar slightly then vigorously. Does the syrup mix with the other liquids?
6. Continue for each solid item until you have placed all the objects into your jar. Did they sink, float, or settle somewhere in-between?
7. Draw a new diagram of the layers in the jar. Include all of the objects, labeled in the places they are now floating.



Extensions:

- Put the lid tightly on the jar. Gently turn the jar upside down. What happens to everything inside the jar?
- Put the lid tightly on the jar and shake it up. What happens to everything inside the jar? Are there the same number of liquid layers that there were before? Where are the solid objects compared to where they were before?
- Add a small amount of detergent and observe what happens. Detergent creates longer lasting emulsions, which is why it is used to remove insoluble materials from clothing.

