Floating Eggs

Summer Science Fun

What We Will Explore

Do the properties of water change when a substance is dissolved in it? In particular, since some objects float on water and others sink, how will floating and sinking behaviors be changed, if at all, by dissolved substances in the water?

Materials Needed

Per Group

- a tall, clear plastic or glass drinking glass or similar container (One-liter, clear plastic soda bottles with the tops cut off and the labels removed are excellent.)
- a cup of salt (kosher salt works best) or a cup of sugar
- an uncooked, unbroken egg (in the shell)
- spoons for measuring and stirring
- paper or cloth towels for cleanup
- pitcher of water or sink for filling containers
- sink for discarding solutions and plain water
  (If this activity is done outdoors, the water can be poured onto gravel or plain dirt [dilute salt water first]. Do not pour salt water onto grass or concrete.)
- hard-boiled egg (optional)
- Explorer Activity Sheet

Safety Considerations

Spills can create wet floors; be careful of slipping. Don't use glass containers unless you have to since they are breakable and broken glass is a hazard. Make sure your explorers know not to drink any of the solutions they make. It is never a good idea to taste things in the "laboratory."

Adaptations for Explorers with Disabilities

- Explorers with hearing impairments should be able to do this activity without any modifications other than those necessary for communicating instructions.
- Explorers with mobility impairments can work with a partner.
- Explorers with visual impairments should be able to feel where the eggs come to rest with some assistance from a partner.

Curiosity Starter

Demonstrate that dissolving a solid in a liquid doesn't always cause the volume of the liquid to increase. Put a long, thin stirrer (such as a cake tester or a kabob skewer) into a clear plastic or glass drinking glass. Fill the glass all the way to the top with water. Measure about two tablespoons of kosher salt into a second empty glass. (We suggest using kosher salt instead of regular salt, because kosher salt dissolves to give a clear solution. Regular salt contains drying agents that make solutions a tiny bit cloudy.) Get your explorers to decide whether they think you can put all of this salt into the glass of water without making it overflow.

Gently sprinkle a little of the salt onto the surface of the water. Using the stirrer, gently stir the water until the salt dissolves. Stir very carefully so that the water doesn't splash out of the glass. Continue adding salt from the pre-measured amount in your glass into the full glass of water, stirring gently after each addition until the salt dissolves. How much of the salt can you dissolve without overflowing the glass? (If you are careful not to splash any of the solution, you will probably be able to dissolve all of the salt into the water.)

Ask students questions like these:

- Since there has been no change in the volume of the liquid (that you could detect), how is the solution different from the water without the salt? (Try to get the explorers to suggest that the mass [weight] of the solution must be larger, since all of the solid is now in the glass, as well as all of the water you started with.)
- What might be different about the properties of the solution compared to the water with which you started? What might be tested? (See if your explorers know that objects [including people] float better in salt water [the ocean] than in fresh water. Try to get them to suggest a floating/sinking exploration with various dissolved solids [salt and sugar are good to start with] and some interesting test object, such as an egg.)

What to Do

Materials Preparation

- Set up the containers, water pitcher (if necessary), salt or sugar, spoons, eggs, and towels at a station for each team.
- Find a suitable place to empty the water and solutions when the activity is complete.

To Prepare for Next Time

- Empty, rinse, and dry all glasses, pitchers, and spoons.
- If the eggs aren't damaged, they can still be used for cooking and eating.

Guiding the Exploration

(See also the questions throughout the Activity Sheet.)

As long as some groups choose to investigate sugar and others salt as the dissolved substance, let each group decide which it wants to do. When the explorations are complete, have all the groups share their results. Have the "salt groups" compare their results with the other "salt groups" (and the "sugar groups" with the other "sugar groups") to see how reproducible the results are. Then they can compare the salt and sugar results to see how different or similar they are. Encourage discussion of the reasons for variability (different amounts of water to start with, for example) and for differences between solutes (different densities for the same amount of different solutes). Some questions you might ask during the exploration are:

- What happens to an egg placed in plain water?
- What happens to the salt or sugar as you mix it into the water?
- What happens to an egg placed in salt or sugar water? Does it matter how much salt or sugar is added?
- Would you get the same results with a hard-boiled egg? Try it. What other objects might you try?

Where to Go from Here

For more activities, check out the following books: *Thomas Edison for Kids* by Laurie Carlson (Chicago Review Press, 2006); *Exploratopia* by Pat Murphy, Ellen Macaulay, and the staff of the Exploratorium (Little Brown & Company, 2007); *Stellar Science Projects about Earth's Sky* by Robert Gardner (Enslow, 2007); and *Bet You Can* and *Bet You Can't*, two books by Vicki Cobb and Kathy Darling. For additional information on eggs, you might want to explore the picture book *An Egg Is Quiet* by Dianna Aston with illustrations by Sylvia Long (Chronicle Books, 2006).

Why It Happens

In the Curiosity Starter, you should have found that quite a large amount of salt could be dissolved into an already full glass of water without making the water spill out of the glass. When salt, or many other substances, dissolves in water, the tiny particles (ions) of salt find places to fit in between the water molecules. Therefore, the water level doesn't have to rise in order to hold the salt. If you keep adding salt, eventually you will reach a point when no more salt will dissolve, and at that point you will have a saturation solution. After that, if more salt, or anything else, is added to the water, the water level will have to rise to make more room for it.

An egg sinks in plain water because it is denser than water. The egg weighs more than the water it displaces. (Note: An egg that floats in fresh water is not a fresh egg! Use another egg and discard the first one!) The egg floats in salt or sugar water, if it is salty or sugary enough, because the egg is less dense than the salt or sugar water. The egg weighs less than the solution it displaces and, therefore, there is a large enough buoyant force to hold it up. By adding salt or sugar to the plain water, you increased the amount of material taking up the same amount of space, so the density of the liquid has increased.